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AUGUST, 1938

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AVIATION
August 1937



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August 1937

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for year ending July 1, 1938

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Passenger miles flown	424% increase
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the Screw

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goes straight



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STANDARD
August 1950
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4

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AVIATION

August, 1938

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THE
CLOSEST AMERICAN
AERONAUTICAL MAGAZINE

AVIATION

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THE
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From the Skyways
of the World

What's In This Issue

Story of the month is, of course, the Dayton flight and we are particularly inclined to bring this to ground in our narrative background. In the pages that follow will be found Mr. Dayton's own account of the experience of the flight, and very welcome by members of the Aviation and particularly qualified to discuss the various things that went on. Don Hall writes July of Dayton called Ben Soren gives details of the flight's unique weather network. . . . Ben Soren has built up an outstanding maintenance shop at Dallas. Our West Coast editor describes what he saw there in a recent visit and gives us insight into the maintenance philosophy of Douglas Aircraft. With language somewhat trampled in the office, the problem of the relationship between cause and effect is important. Mr. John Schmitt, an expert of the relationship of the problem and solution, has made an extensive study of the problem and outlines the methods to be followed in making such relationships. . . . Dayton's account of the Carter-Walker flight is the first time in the extensive article in AVIATION by Carter-Walker's director of operations T. J. Walker. . . . Other flying equipment includes the first report of Hercules' "Big Twin" powerplant like A 2 C4 Aeronaut by Phillips, and the first description of an improved flight control instrument developed by Irving Kistler and the Pilot's Aid Control Company.

experience when we hear the latest Model H Waco at Floyd Bennett Field several days ago. Through the courtesy of Ed Erickson we were permitted to make several flights at his personal shop under the coaching of Jack Loring, one of his pilots. After making only one demonstration take-off and landing, Jack threw the wheel over and said, "Here, you do it." Some more of our flying during the past twelve months has been riding around in the back seat of transports, we took over with some reluctance, but the minute we pulled open the throttle and started down the runway any fears that we had vanished instantly. It was no trick at all to bring her up to flying speed and lift her off as naturally as you could push an automobile away from the curb. In the air she was really beautiful to handle. Under Jack's coaching we brought her in at 1,000 ft. over the end of the field, flipped the flaps down, dropped the speed to 80 m.p.h., and simply cut right while the field came up in front. Just a bit of a dip, and before we touched the ground and we were rolling along the runway almost before we realized that we had touched ground. When a man handles a pilot can land the first time around with as little trouble as that, there is certainly no reason why anyone should not be able to do it. It was a very com-

AMERICA'S PILOTS IN THE KENDALL HALL OF FAME



PAUL BRITAN, one of the MARCONI-SADWORTHY RACING PILOTS

On May 24, 1918, Paul H. Brittan, Chief Pilot of Super Flying Service, San Diego, Cal., established a new world record: a 1000-mile speed record of 255.915 miles per hour when he won the 1000-mile Golden Gate Exposition Trophy Race at Oakland in his Marconi-Sadworthy racing plane—using Kendall. The 1000 Mile Oil. On June 1, Mr. Brittan again used Kendall Oil in establishing his record on the San Diego record of 1 hr. 48 min. 7 sec.

IN THE Pacific International Air Races, held at Oakland, Calif., 15 out of a possible 16 winning pilots used Kendall, The 2000 Mile Oil, in their planes. That 93.75% of the winners in these grueling contests of speed and endurance relied upon Kendall Oil for dependable lubrication is conclusive proof of Kendall's quality. Kendall is refined exclusively from Bradford, Pennsylvania Crude—the finest crude in the world. Special Kendall refining processes develop to the full its native lubricating excellence. The premium quality oil thus obtained is protected from contamination by individually numbered, refinery-sealed cans. You will find Kendall, The 2000 Mile Oil, at most airports throughout the country.

offering demonstration and to affirm our conviction that the three-wheel type have really got something.

► **RESEARCH** in the aviation business should make a point of visiting the "Wood Brothers" store in his vicinity every once in a while, for the quality of work done and the ship-shape way in which ground and flying equipment is kept in an inventory to someone who has anything to do with aircraft. Lt. Commander Roland E. Knutson, now skipper of the U.S. Naval Reserve here at Floyd Bennett, is constantly to be congratulated upon the appearance of the line—but the mere use is vital of all Naval Reserve units that we have ever seen, from Illinois to Seattle.

► **ALTHOUGH** these notices are not merely a part of the Department, we get into a bit out of reading Commander Edward Ellsworth's "Yell on Ice" that we want to mention it is passing. The story of the voyage and loss of the "Jeannette" and the tragic story of Commander DeLong and his party, goes up the sharp contrast between Arctic exploration in the past and the present. From the ice, the "Jeannette" drifted suddenly at the mercy of the ice-packs, only to be crushed after six months. After the loss of the "Jeannette" the crew by tremendous effort and terrible hardship could make good only a mile or two a day over the ice fields. Such this up against the recent flights of the Blériot over the Pyrenees and the work of Ellsworth and Sir Hubert Wilkes. And in the near future it is not impossible that Moscow-New York air lines will be running on regular schedules over the Lena Delta where disaster finally overtook the DeLong party.

► **FOLLOWING** this story recently set by Hal Hibbard, Vance Berne, well-known test pilot, retired to the Good Samaritan Hospital in Hollywood, for an appendectomy. At last reports he was doing well. Removal of one very satisfactory appendix dispensed Vance's long-standing conviction that repeated structural velocity power drain and 9G pull-outs had caused his appendix to desert and vanish from flight.

► **THE** New York University Class was the scene of a pleasant little dinner on July 6th, given by the brothers Townsend and Nicholas Laidson to give Jack Rafter an opportunity to demonstrate to air line and aerospace engineers the advantages of his con-



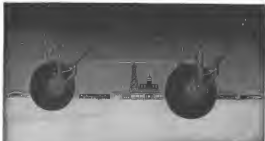
rod-light landing system. Chief feature of the scheme is to provide lighting of maximum intensity through the glass of the center line of a runway. The luminescent substances containing interference of flood lights, and it said to be far penetrating in a remarkable degree. Plans are under way to make a test installation of the rod lighting at Tusculum under the

supervision of the Bureau of Air Commerce. Details of the system will be available in an early issue.

► **IN** view of the large eastern cities an ordinance has been passed to name the municipal airport, now under construction, in honor of the mayor. Being familiar with the experience of a large southern city in a similar case, we'd like to suggest naming the airport after it has been completed. In this other case the politicians for whom the airport was named came into great disfavor with the citizenry a few years later and it was decided to change the name of the airport. An investigation showed that the politicians were had been stamped in every track and out into the stone work of every building, worked into the tile design of the floors, and woven into the faces and added into the plumes of the restaurant. The citizens had the choice of having the name unchanged or having a new report.



"Maybe with himself a little less he can with his good-looking woman be."



WHEELS DOWN... THEN LANDING IMPACT... THEN *Braking!*

In no other form of transportation does so complete a change of condition and of mechanical functions take place as in the moment of ground contact in an airplane. In this instant the shock of landing impact has been absorbed. Have flight characteristics become unimportant; automatic steering and quick, smooth stopping become vital. Up to a down-land must be stopped from mile-a-minute speed in a few seconds. The pilot's feet have smacked his brake pedals in anticipation. He applies pressure judiciously, firmly. Air and ground resistance both affect his direction, he varies his braking pressure to compensate, keeping the quest place to a smooth, positively controlled stop. He steers with his Bendix Brakes. They respond with instant security and tremendous effect, because Bendix engineers, with the kind of sense and leading gear design and performance at their disposal, have done a proper job. They stand eagerly ready to do the same for every aircraft builder.

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AVIATION
August 1937

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BY
**ROBERT
OSBORN**

IN THE SECOND ISSUE the *Stoney Cox* party has developed a novel custom in regard to their huge airplanes. As soon as they roll a new project out for flight and Company officials announce to an amazed aeronautical world that shades they are building a bigger and better design in the shape already. At first we thought there had been a printing complex because their engineers don't like working with drawings, or because of a faulty ball of mis-translated steel, or because who couldn't handle more than a half



inch thick, but now we think we have the real reason. They're hoping to build a ship big enough to really surprise and please Ed Allen.

They should be able to achieve this intention in similar shape or two as their ships are about large enough now to be considered as possible U.F.A. projects.

IN A NEW ISSUE AND this column would appear to have been a successful campaign to obscure newspaper writers in certain matters pertaining to aviation. In regarding the numerous attempts to break the atmospheric speed record at Daytona Beach

on the Brownsville 20th floor the favorite phrase of the newspaper man was that the car finished just then as fast it could be seen only as a blur or a streak. The only reason that had condition we offered to provide insurance from the press boxes at the National Air Races who were able to see airplanes enter slowly as they passed the stands at speeds that a hundred miles an hour faster.

Now it seems we must take these reporters on hand again as they have had every mass flight of airplanes "darkening the skies." We've witnessed many such flights in our time, some of which seemed terrible all the airplanes of the Army and Navy, and never more have we seen the skies darkened. On the contrary we recall being able to read newspapers clearly, and being able to see most of each without proportions to C. B. Allen and Slattery Schaeffer calmly at distances of one hundred feet.

Probably the air forces of Soviet Russia and some other European powers could do a better job of darkening if they flew all of their ships at once but even then we doubt if any airplanes go to meet or counter-attack at top-lighters rush through the city streets.

So, if reporters persist in using this phrase in the future, we're going to write his letters in their names demanding information on just how many top carders of illustration was lost.

IN SINCE, RECENT TIMES it has been the custom to demonstrate before comprehensively with numerous which feature original American be kept lighted for all eternity. If the parachute societies of this country ever consider a joint memorial for all of the pioneering aeronauts, flights which have been made we are going to suggest a more suitable of this time-honored scheme of perpetual fire. We think it would be much more appropriate than an annual stand-prior to have a stone of Greater Value, with his hand extended in a welcome greeting, and with a perpetuity from enemies in the light but no-hole of his authority perfect remains.

IN HYPERBOLIC QUESTION Now that we have air-cooled engines of 1,500 hp in our commercial airplanes and probably still higher ratings available for military airplanes, are we running the days when everybody agreed that air-cooled engines were probably slighted up to about 200 hp, but liquid-cooled engines would be necessary for any powers above that?

IN ANOTHER HYPERBOLIC, in these days of automatic controls, full throttle, constant speed, deeper rigging, superhydrodynamic hot-air-cooled ram-jet water propellers, many fairly slow probably wish for a return of the good old days when propellers were whirled out in his space time by that fellow down in the mud-bag—what?



the best propeller was the one giving the highest reading on a speed scale and to the tail of the ship.

IN AN AMERICAN PRESS between who an agreement between Great Britain, France and the United States is set the hour of landing was at 1:50:00 noon and it was at 1:50:00 noon. If the purpose of this announcement was to impress any personal enemies who are showing signs of getting up, we think a good publicity man would have suggested it. For instance these powers could have agreed just as early that such battleships have only two playing steps on the ball and carry not more than six four-engined flying boat bombers as outposts.

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The Appoint—"minis with the hCIs."

THE LONG AWAITED WHITE HOUSE ANNOUNCEMENT of personnel for the Civil Aeronautics Commission left us in a flat spin. We were prepared, of course, for a certain amount of deviation from ideal in the makeup of the Commission. A perfect lineup would have been too much to hope for. We were optimistic enough, however, to think that there would be enough general strength in the makeup of the Authority to make that offset the weaknesses. But adding up the scores as characteristically as possible, the aviation talent in the C.A.A. stacks about fits a picture of gaps in an empty tank.

The first failure head of Jett Farley seems definite in evidence in the debate. He has simply added another outside chapter to his non-aviation record. But that the appointments are one hundred per cent wrong is, of course, as unlikely as their being completely right. It is the shocking lack of balance in the Commission that landed us in for reversed logic.

The choice of administrator was a real surprise. The man who is ultimately responsible for such highly technical matters as passing on the design and airworthiness of aircraft, of issuing pilot's licenses, of supervising radio installations on airports, and airports, should at least have had some prior contact with such matters. Mr. Elster has done an excellent job in his own field, but his experience has been entirely in the legal aspects of the Treasury and other government departments. True, he did previous service in drafting the Tax bill and doubtless exercised conscientious, but his background would suggest an assignment as legal adviser, or even as a member of the Commission, rather than the job of its chief executive. His extensive knowledge of the processes of government should be an asset. Mr. Elster has a doubly difficult job on his hands of selling himself in a skeptical industry and then proving that he will carry out his assignments according to law, open lights, and not as a rubber stamp for the White House.

With the selection of the chairman we have less criticism. As the creator and exploiter of "Life-Savers" Mr. Kille is a man whose proven business and executive ability can contribute a much needed element into aviation affairs at the moment. At least he has had some contact with the industry through his financial activities and ownership of several airplanes. With a properly balanced Commission behind him his first approach could be a tremendous asset.

Little objection can be raised over the appointment of

Harold Housh. He has had long and useful experience with the air mail and can make a real (although specialized) contribution. His appointment was expected and well doubted he generally approved by the industry. He knows little of the technical aspects of airplane operations, however, and has obviously close connection with Jett Farley is a bit disturbing.

Mason is the only member who has had any really adequate aviation experience, but it has been pretty much one-sided, confined almost exclusively to Pan American's problems in the Caribbean. He has executive talent and business ability however.

The other two appointments look pretty doubtful as far as aviation is concerned, and are chiefly responsible for throwing the organization as completely out of balance toward the political side. Mr. Ryan is a former Federal Power Commission lawyer (allegedly a Left Wing New Dealer with a yen for public ownership) but with no aviation experience whatsoever as far as we can discover. Mr. Hackley claims a long aircraft interest in aviation, is known to be a persistent airline rider, and once had an interest in a now defunct flying service in Ogden, Utah. Lately he has been WPA Administrator for five western states, and is said to be a pal of Harry Hopkins. At best, his total aviation record could be summarized by a handful of names qualified men that we could name. The substitution of one sound aviation man of long experience for either of these two would have restored a certain semblance of balance to the whole, and would have changed the situation.

The safety board appointments, however, make more sense. Both Martin and Smith are men of potential experience, one as an airline pilot (as reported by the law), and the other as an airport engineer (WPA). Much will depend on the third appointment. A trained aeronautical engineer with sound practical experience would round out the safety board very nicely—whether politician would rate is a question. A technically strong safety board which was in an adverse a great deal more than investigation of accidents, was, in a technical advisory body, do a great deal to balance up the Authority.

Well, the law is now the law, and the Commission is now its administrator, and we are going to have to live with both of them for a long time (unless the Senate refuses confirmation next January). Instead of being able to take off immediately on a new program of aviation for America as we had confidently hoped, at best we have got on our hands another long-term educational job that must be completed before any really worth while results can be expected. We will all have to be extremely patient and extremely cooperative, as it will take the Commission a long time to get its feet on the ground and find out what this business is all about.

Somehow Charles-Fred Sawyer is the Pan American aviation man for larger trans-Atlantic flights. But in addition, Boeing, Consolidated, Sikorsky, and Douglas, all but the Consolidated have an interest.



Howard Hughes RADIO

By Donald Fink

Brian Edgar, Narrator

used throughout the flight for almost all communications work and other broadcast work.

The actual transmitter (a Bendix) was about 100 watt power with 15 frequencies, double-duty service of the frequencies used in the Hughes transmitter. It was installed in a flat line of defense in case of failure in the main transmitter.

The first transmitter was combined with a receiver in a frame complex emergency station. It had a power of 15 watts, CW or ICW on four separate controlled frequencies ranging from 16,000 to 200 kilocycles. The receiver had a double frequency range. The power for operation of this transmitter was available from three different sources to take care of various forced landing situations. A hand-driven generator could have furnished power to both the transmitter and the receiver indefinitely, and in case of any damage to the hand-driven generator, sufficient battery power had been built into the unit to operate the transmitter for several hours at full power and to shut it down to the hand-driven generator. Complete accessories, such as telegraph key, numerical keyboard, number set, were attached directly to the unit to set up a total distance of approximately 1500' x 30'. All controls and the means for the emergency transmitter were thoroughly waterproofed to withstand long immersion, the whole being sufficiently buoyant to float easily. The total weight was approximately 35 lbs. exclusive of the hand-driven generator. A kite and a balloon were available to meet the emergency in case of other support was otherwise needed.

The receiver comprised isolated two Bendix super-heterodyne cover up low and high frequency. One of these was normally used for communications work and the other for direction finding in conjunction with the direction loop. The third receiver was the emergency receiver actually mentioned. The fourth was a portable loop receiver used with the Keesee radio compass.

The location of the equipment in the plane was, of course, very important from the standpoint of operating convenience and for this reason the interior of the plane was designed in the airplane compartment. The only unit located in the tail was the 100 watt emergency transmitter and one Bendix receiver. The operation of all the units was made extremely flexible by the use of interlocking relays to switch the two trailing antennas to the proper units without trouble in the down line. The two trailing antennas comprised a Heise & Kaufman electric net for the high frequencies and a hand spread net for the low frequencies with automatic provision for switching to either of the two nets when it was desired to do so.

The electric net was coupled to the main transmitter up forward by means of a 300 ohm concentric transmission line provided with a means of adjustment from the operator where the antenna impedance was correct, as shown by the absence of standing waves on the line. The antenna length could be varied from a half-wavelength of quarter wave long with little trouble. By varying the number of quarter waves the directivity of the antenna could be set up to give a total distance of antenna direction, therefore, could be practically doubled. A feature of the high frequency antenna was the fact that it was entirely clear of the ship, the concentric transmission line extending right out through the tail fin.

The stop-phone system was also of great interest because of its flexibility. It operated between three positions in the plane—the station of the pilot, the radio operator and the navigator. The pilot and the radio operator could not only communicate with each other but the navigator had could switch either head phone of drive ship's head sets in to monitor any of his events. The stop-phone circuit was also arranged to automatically break into any of the three circuits when intercom was not in use.

(Continued on page 77)

Howard Hughes WEATHER

By Daniel Seyro

ARTHUR EDWARDS, Narrator

THE PROBLEM of providing weather information for a flight which was to traverse at Howard's four local around the world flight, in one which requires considerable preparation, began long before which will lead to a series of operations. One particularly the first immediate need which presented itself was that of collection of weather information that reflected in either a thorough analysis. In order to provide this data, W. C. Black set up a radio weather station at the World's Fair where only paper was to provide the regular scheduled communications of weather data from various stations in various parts of the Northern Hemisphere. In order to facilitate the operation of the radio phase of this project the receiving station was combined with the communication station, and the whole thing placed under the direction of Mr. Charles F. Pryor. He also provided for weather intercept facilities, to simplify the problem of obtaining observational data at World America.

There are several special radio transmissions from numerous stations in Europe which provide useful data, but in order to preserve the safety of the flight from the standpoint of the collection of complete data in the air, it was necessary to have the means of communication in the air. Maps & a staff of four men with navigational data helped the flight in the day and night. That data was recorded first which was most important in the particular leg of the flight as a whole, so that the partial map could be combined and the lowest part of the flight could be made. Thus, the data from the various stations was completely analyzed within seven hours after the time of the observation.

The entire organization described above was set up to spend two weeks before the start of the flight from New York in order that a few nights be chosen which would be most suitable for the flight. In choosing the time it was necessary to consider several factors.

One of the main international route at least one world map was compiled such that at Howard's four local quaters, mostly based upon the observations taken at 1000 GMT simultaneously at the way around the world. Secondly, the observation period was the major part selected in the area north of 30 degrees north latitude, and south of 80 degrees north latitude.

The collection of the above data required about one hour of nearly steady operation all day, noon, with four operators all based in different stations. In order to provide against such contingencies in local transmissions in the region of the Atlantic, with the military communication, one of the main radio stations in the communication network, WTRU, owned by Ralph Thomas at Queens, New York, stood ready at any time to take in any broadcast with which they might be having difficulty at headquarters. A direct telephone line between World's Fair local quaters and WTRU allowed it to obtain such data after it was received. This provision presented an interference from local data on any map during the entire project.

At these headquarters were located a staff of four men to take the data and make the observations in the air. Maps & a staff of four men with navigational data helped the flight in the day and night. That data was recorded first which was most important in the particular leg of the flight as a whole, so that the partial map could be combined and the lowest part of the flight could be made. Thus, the data from the various stations was completely analyzed within seven hours after the time of the observation.

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William G. Bushfield, Boston, took about 1000 photos in every phase of the flight, which was to New York in order to make only one weather map.

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Checking Up



Maintenance shop on Term 21st. Did to make sure of shops which fly again within a day.

average of less than three to an average of more than eight. And in new planes, engines, and accessories have been landed the Braniff shops for maintenance, changes has become a task with the organization. Every move made by Braniff maintenance men seems to have back of it the thought that to-day's best methods will not be good enough tomorrow.

With all Braniff's maintenance what is Rogers C. Stenkel, maintenance superintendent. Around Braniff he has built a team that any maintenance man and, indeed, any employer of men, might well envy. In these men the jobs they are doing are the most

at **BRANIFF**
THE B-KING
Airways

Cutting Through the Heart of America from Chicago to the Mexican Border, Braniff Makes Connections with Every Major System on the Continent.

reliable and inspiring in the world. Each one shows and breathes his special brand of maintenance. And together they make the present job and the future problems with a tenacity which will tolerate nothing short of perfection.

Space does not permit a biography of all the Braniff maintenance men, or a very complete record of the achievements of Stenkel himself. Rogers C. Stenkel is not yet 30 years of age. At the age of fifteen he had sailed and was making parachute jumps and giving flight instruction. At seventeen years of age he was chief mechanic and relief pilot for Braniff Airways. He worked his way through school by doing wing walking and parachute jumping during vacation periods. After high school went on to several colleges at which technical training was secured. At twenty years of age Stenkel was superintendent of maintenance for Brown Airlines and supervised the Brown planes for five years without incurring a single accident although working without many of the facilities now considered essential to proper main-

tenance work. Before coming with Braniff Airways to take charge of maintenance Stenkel had worked with Southern Air Transport, Gulf Coast Airways, American Air Lines and Delta Airlines, in addition to those already mentioned.

With such a background of practical experience and technical training Stenkel has combined a rare quality for selection of men qualified as he is to personally do the jobs to which they are assigned. The result has been a philosophy of maintenance that is everywhere different from that of most other major organizations. In the Braniff maintenance system, every move seems directed at increasing the responsibility and the initiative of the individual, whether he may be an apprentice, a crew chief, or the shop superintendent. The better the work, and reduce it as it is everywhere around. When Stenkel took charge of Braniff maintenance it is significant that he completely eliminated 36 of the forms then in use in connection with servicing, maintenance, inspection etc. A study of all maintenance systems was made and the various forms finally adopted were developed. (Continued on p. 40)



The new maintenance shop with its radiography, inspection and machine maintenance.

OF THE MOST EXPERIENCE and inspiring chapters in the record of airline maintenance is being written in the shops of Braniff Airways at Dallas, Texas. From the original Shreve Detention, of modest construction, the Braniff fleet has grown through acquisition of Alwood Lockheed Vega, allwood Lockheed Electra, to the present fleet of Douglas DC-3s and Lockheed Electra. As the number of planes in service has grown, and types of planes used has changed, the Braniff shops have expanded as mobile around, for reliability of equipment in service and lowest cost of maintenance. These hours three per day have increased from 25



Walter Stenkel
Superintendent Instrument Shop

Jimmy Stenkel
Overhaul Superintendent



The New-Braniff Stenkel
Superintendent Instrument Shop

George Correll
Superintendent Airplane Overhaul

Frank Eyer
Radio Maintenance

E. H. Stenkel
Chief Inspector

By
George S. Schairer
Consultant Aircraft Corp.

The big questions asked about big airplanes today are, How far will they go? and How much will they carry that fast? Another question which is almost secondary in importance is, How long will it take them to get there? The purpose of this article is to indicate a way to answer these questions.

RANGE VS. PAYLOAD

THE RANGE of an airplane is affected by its weight, speed, fuel load, engine R.P.M. and other factors. The effect of each item can best be studied by looking just how each affects the miles per lb. of fuel of the airplane. The miles per lb. of fuel at specific range, is equal to the speed in miles per hour divided by the pounds of fuel used per hour. The power required at any given condition of speed and altitude is given by the familiar formula,

$$HP_{req} = \frac{C_D \times \frac{\rho}{2} \times V^3 \times S}{550} \quad (1)$$

The power available from the engine-propeller combination is HP_{avail} or Propulsive Efficiency \times BHP per engine \times No. engines. In level flight the power available must be

equal to the power required: BHP_{req} = HP_{req} and

$$C_D \times \frac{\rho}{2} \times V^3 \times S \times \frac{550}{\eta_p \times \eta_{prop}} = \text{BHP/Eng} \times \text{No. Engines} \quad (2)$$

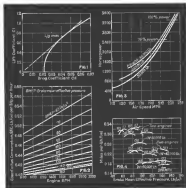
The engine used propeller power coefficient

$$\eta_p = \frac{P}{P_{prop}} \quad (P = \text{BHP/Eng.} \times 550)$$

is useful at this point. The BHP/Eng. in equation (2) will be replaced by

$$\text{BHP/Eng} = \frac{P_{prop} \times \frac{\rho}{2} \times V^3 \times S}{550}$$

$$C_D \times \frac{\rho}{2} \times V^3 \times S \times \frac{550}{\eta_p \times \eta_{prop}} = P_{prop} \times \frac{\rho}{2} \times V^3 \times S \times \frac{550}{\eta_{prop}} \quad (3)$$



This equation is simplified to

$$\eta_p = \frac{C_D \times \frac{\rho}{2} \times V^3 \times S}{P_{prop} \times \frac{\rho}{2} \times V^3 \times S}$$

= $\frac{C_D \times \frac{\rho}{2} \times V^3 \times S}{\text{Total Operating Prop. Horse Power}}$ (4)

The last part of this equation is the ratio of wing area to total operating propeller disk area. The term η_p is the propeller power disk loading coefficient. It differs the power absorbed by the propeller. It is possible to plot curves of all propeller efficiency versus V/ND for constant values of η_p . This was done for the three-bladed propeller tested by Galt and the results are plotted in Fig. 5. From equation (4) it is seen that for a constant value of C_D there is a corresponding value of η_p and a unique variation between η_p and V/ND. Thus, knowing C_D and V/ND, the propeller efficiency is readily determined. Since C_D is determined entirely by the attitude of the airplane, the efficiency is a function only of the ratio of forward speed to propeller R.P.M. for any given

airplane and, in this airplane is flying at constant speed, altitude and weight, the η_p vs. V/ND curves are curves of propeller efficiency versus R.P.M. This gives a very direct method of obtaining the effect of R.P.M. on propulsive efficiency.

To describe the method of using this chart for selecting range a sample computation has been made for a typical airplane. The airplane used is a 40000 lb., 4 engine land transport. The engine area of 1825 sq. in. displacement gives 18 to 6. They are rated at 1800 HP at 2500 R.P.M. or 5800 ft. The cruise range is 2300 N.M. and BHP/Eng is 160 lb./sq. ft. The propeller are 115.5 in. in diameter with three blades. The airplane itself has a wing area of (From page 71)

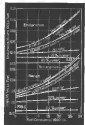
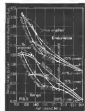


Table I
RANGE CALCULATIONS
Example Airplane—8000 Ft.

Altitude (ft.)	Speed (mph)	Time (hr.)	Range (mi.)	Altitude (ft.)	Speed (mph)	Time (hr.)	Range (mi.)
8000	100	1.00	100	8000	100	1.00	100
8000	110	0.91	110	8000	110	0.91	110
8000	120	0.83	120	8000	120	0.83	120
8000	130	0.77	130	8000	130	0.77	130
8000	140	0.71	140	8000	140	0.71	140
8000	150	0.67	150	8000	150	0.67	150
8000	160	0.63	160	8000	160	0.63	160
8000	170	0.59	170	8000	170	0.59	170
8000	180	0.56	180	8000	180	0.56	180
8000	190	0.53	190	8000	190	0.53	190
8000	200	0.50	200	8000	200	0.50	200
8000	210	0.48	210	8000	210	0.48	210
8000	220	0.45	220	8000	220	0.45	220
8000	230	0.43	230	8000	230	0.43	230
8000	240	0.41	240	8000	240	0.41	240
8000	250	0.39	250	8000	250	0.39	250
8000	260	0.37	260	8000	260	0.37	260
8000	270	0.35	270	8000	270	0.35	270
8000	280	0.33	280	8000	280	0.33	280
8000	290	0.31	290	8000	290	0.31	290
8000	300	0.30	300	8000	300	0.30	300
8000	310	0.28	310	8000	310	0.28	310
8000	320	0.27	320	8000	320	0.27	320
8000	330	0.25	330	8000	330	0.25	330
8000	340	0.24	340	8000	340	0.24	340
8000	350	0.23	350	8000	350	0.23	350
8000	360	0.21	360	8000	360	0.21	360
8000	370	0.20	370	8000	370	0.20	370
8000	380	0.19	380	8000	380	0.19	380
8000	390	0.18	390	8000	390	0.18	390
8000	400	0.17	400	8000	400	0.17	400
8000	410	0.16	410	8000	410	0.16	410
8000	420	0.15	420	8000	420	0.15	420
8000	430	0.14	430	8000	430	0.14	430
8000	440	0.13	440	8000	440	0.13	440
8000	450	0.12	450	8000	450	0.12	450
8000	460	0.11	460	8000	460	0.11	460
8000	470	0.10	470	8000	470	0.10	470
8000	480	0.09	480	8000	480	0.09	480
8000	490	0.08	490	8000	490	0.08	490
8000	500	0.07	500	8000	500	0.07	500
8000	510	0.06	510	8000	510	0.06	510
8000	520	0.05	520	8000	520	0.05	520
8000	530	0.04	530	8000	530	0.04	530
8000	540	0.03	540	8000	540	0.03	540
8000	550	0.02	550	8000	550	0.02	550
8000	560	0.01	560	8000	560	0.01	560
8000	570	0.01	570	8000	570	0.01	570
8000	580	0.00	580	8000	580	0.00	580
8000	590	0.00	590	8000	590	0.00	590
8000	600	0.00	600	8000	600	0.00	600
8000	610	0.00	610	8000	610	0.00	610
8000	620	0.00	620	8000	620	0.00	620
8000	630	0.00	630	8000	630	0.00	630
8000	640	0.00	640	8000	640	0.00	640
8000	650	0.00	650	8000	650	0.00	650
8000	660	0.00	660	8000	660	0.00	660
8000	670	0.00	670	8000	670	0.00	670
8000	680	0.00	680	8000	680	0.00	680
8000	690	0.00	690	8000	690	0.00	690
8000	700	0.00	700	8000	700	0.00	700
8000	710	0.00	710	8000	710	0.00	710
8000	720	0.00	720	8000	720	0.00	720
8000	730	0.00	730	8000	730	0.00	730
8000	740	0.00	740	8000	740	0.00	740
8000	750	0.00	750	8000	750	0.00	750
8000	760	0.00	760	8000	760	0.00	760
8000	770	0.00	770	8000	770	0.00	770
8000	780	0.00	780	8000	780	0.00	780
8000	790	0.00	790	8000	790	0.00	790
8000	800	0.00	800	8000	800	0.00	800



Model 20 Transport

By T. P. Wright

Director of Engineering
Curtis Wright Corporation



SAFETY AND ECONOMY—on these characteristics has major emphasis been placed throughout the development of the Curtiss Wright "20" Transport. Each design innovation suggested for consideration has had first to be proved of value in improving these qualities before its adoption could be authorized. In designing for maximum safety and low operating cost, flight has not been lost however of the need for optimum performance (which is fact when observed by mechanics, pilots, and a competent economist) for maximum comfort for reliability and for convenience.

Convenience implies not only suitable arrangement of the cabin but also frequency of schedule. The "Super Economy Hour on the Floor" represents a real asset to the air traveler permitting him to take full

advantage in scheduling his work and of the speed of travel which brings wherever he wishes. Numerous discussions with air transport operators convinced Curtiss-Wright that a plane accommodating thirty passengers with a great degree of comfort and luxury would be best suited, particularly to those large centers of population, to make possible frequency of schedule so desirable for the air traveler. Whereas rail transport can meet various fluctuations in traffic by addition or removal of coaches from a given train, air transport must have a service constructed around units of such size that the dual requirements of frequency of schedule and large payload and capacity can be simultaneously held. However, not too small a unit can be used, so that sufficient comfort, luxury and spaciousness can



Charles Francis Bell, George Fennell, and George Fennell inside the fuselage of the Model 20, showing the interior layout.

not be offered. Once having fixed on a luxurious cabin, passengers are assured in fact it necessary to ride in a less comfortable one on a rapid quest trip. The Curtiss-Wright "20", providing a cubic foot space of over 9.5 cubic feet per passenger in a cabin having dimensions of 69 ft. high by 57.5 ft. wide (at window height) by 26.5 ft. long, gives a size of such spaciousness that further increase would not provide proportionate increase in comfort and luxury—it added very little.

A further point emphasized in the airplane is superior vibration-free flying, smooth and rapid. The 400 cu ft. of space provided for those not immediately adjacent to engine compartment, these considerations the thought which inspired the designers had in mind of permitting an operator using the equipment to carry a large cargo load with his passengers; the ease is to any confusion or interference with the other. All mail, baggage and baggage is located under the floor. Access to it is from the outside by means of large doors on each side. The compartments are readily accessible in loading from the ground. Particularly, all of the space mentioned is available unoccupied for payload in a separate compartment under the wing of 75 cu ft. is provided to house all accessories such as batteries, auxiliary radio, hydraulic oil supply tank, de-ice fluid tank, water tank, valves, etc.

Provisioning of the dual shaped fuselage is provided for in such a manner structurally as to make possible the arrangement above described without weight increase which a more orthodox shape would present would normally dictate. The answer is the use in cross section of two circles, in-



creasing in such a manner that the floor plane does not cut off any structure, thus acting as a tension tie to withstand loads caused by the tendency of the two circles, when under pressure to separate. Externally, the position is of course fixed so as to present a pleasing appearance as well as a clean one aerodynamically.

In the development of the design technique of the dual provision as well as in the development of mass control in occupying the plane for high altitude flying in general, the project has had the benefit of the services of Dr. John H. Younger who played a very important role in the work through his active cooperation in the pioneering efforts of the United States Army Air Corps in its high altitude development program at Wright Field. Dr. Younger is continuing his consultation on the phase of the design.

The degree of performance provided for structurally is such as to permit normal cruising at 20,000 ft. altitude with equivalent "cubic altitude" of 5,500 ft. Or, alternately, 11,000 ft. cruising altitude with an 11,000 ft. cruising altitude with an 11,000 ft. cruising altitude.

The picture accompanying this description shows the Curtiss-Wright "20" to be a twin engine, mid-wing conventional of all metal, stressed skin construction. The engines are in the Wright 14 Cylinder Double Row Cyclone with take-off rating of 1,600

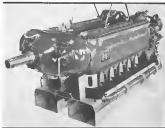
(Turn to page 15)

In the cockpit, three control wheels and the engine arrangement of controls are positioned between the seats. The side panel controls can be seen to the right of the board, below the flying pilot.



The cabin interior is roomy, well lighted. Ample space of two seats each window can be made to have tables for luncheon or for reading.





Unitwin Power Flight Tested

Power plant consists of two 260 hp. Menasco
geared to a single propeller

Four engines were made on June 20th with a new type propeller designed jointly by the Lockheed Aircraft Corporation and the Menasco Manufacturing Company, and which is to be used in a new type light transport plane soon to be introduced by the Vega Airplane Company, Lockheed subsidiary. Of novel arrangement and indicating possible engine changes in design of future two-engine aircraft, the new power plant is dubbed Unitwin Power and consists of two Menasco SBC-4 engine engines of 260 hp. each geared in a single constant speed propeller through a gear box and extending clutches. The clutches are similar to the over-riding clutches used in automotive "line-shifting" and provide completely automatic expansion and compression of the engine and propeller.

During initial flights, the Unitwin powerplant was measured in a special Lockheed Alamo which has been fitted up as a flying laboratory. The Unitwin design is said to have had more than five hundred hours of block testing during the past three years. It is planned to conduct several hundred

hours of flight tests with the new powerplant before it is incorporated in the final design of the commercial plane to be built by the Vega Airplane Company. The Menasco engines used in the present Unitwin powerplant are of standard type with minor changes. Director of rotation of the engines

Unitwin Power Plant Installation in Special Lockheed Alamo



has been reversed in order to use a standard propeller, and interlocking of one engine has been reversed in order to provide a symmetrical installation for cooling and cooling purposes. The engines are rigidly bolted together by means of special crankcase supports and are attached to a single engine mount. Each engine operates as an independent unit. At the front of the two engines a separate gear case is mounted. Each engine drives through this gear case to a single central propeller shaft. Power is transmitted through over-riding clutches in this case, so Curtiss engines may be cut out at will without affecting the other engine. The gear case incorporates an independent lubricating system and the propeller governor is driven from the propeller shaft rather than from either engine crankshaft. Although the engines in the actual installation are mounted in the full reversed position, it is understood that the commercial version will probably "Vee" or "split" the engines slightly to provide better accessibility for servicing and more room in which to mount a cone wheel in the event the powerplant is used with planes using tricycle gear.

Many advantages of the Unitwin type powerplant are obvious on casual inspection of the installation. Easy engine reliability is obtained without sacrifice of simplicity and load reduction. Wing profiles are streamlined. The installation in the Alamo is said to have slightly less

(From page 20)



Curtiss
SBC-3
and
SBC-4
STANDARD
SCOUT-BOMBERS
of the
UNITED STATES NAVY

The 56 Curtiss SBC-4 Scout-Bomber recently ordered by the United States Navy being the total order on this type up to 141 airplanes.

Designed to meet rigid tactical requirements of Navy operations, the Curtiss SBC-3 and SBC-4 types are the standard Scout-Bombing planes of the United States Navy. Powered by Wright Cyclones, the new Curtiss

SBC-4 Scout-Bombers will soon join the 33 SBC-3 type now assigned to aircraft carriers—to scout the way for the battle fleet and under their swift bombing attack.

Fighting planes of such superior design and performance as the Curtiss SBC Scout-Bombers are powerful weapons for National Defense.

CURTISS AIRCRAFT DIVISION • CURTISS-WRIGHT CORPORATION
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Curtiss

PRECISION-BUILT ARMY AND NAVY AIRCRAFT



The New Bell 400 with Cone Gear's new worm gear drive system and automatic landing gear.

In the Air

CONE GEARS SAVE PRECIOUS POUNDS

For aircraft, Cone Worm Gearing's vastly greater load carrying capacity and efficiency is today contributing increased reliability and durability, with less gear weight for such parts as silence controls, retractable landing gears, controllable pitch propellers, gun synchronizers, etc. AREA CONTACT—meshed into Cone Gearing by an exclusive manufacturing process—means just that. Either smaller gears of equal

or worm driven equipment the lowest cost per horsepower. Important tests and years of service prove: Four times the A.G.M.A. mechanical, twice the A.G.M.A. thermal rating. The higher efficiencies known. Up to 30 times the instantaneous tooth contact. Ratios of 150 to one, or 1 to 1. High speed or heavy duty. No special lubricants. And Cone gears—both worms and wheels—wear in, not out. In other words both

regenerate as wear occurs. In conventional worm gearing wear destroys the worm face.

For further information on how Cone Gearing is doing a better job on all kinds of equipment, send for Bulletin No. 30-31

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS ROAD DETROIT, MICHIGAN

located area than a single relief on gear of unsuitable total power. Landing, wiring, and controls are considerably simplified through saving the two engines together. Also there are definite structural economies through elimination of fuselage struts and duplicate engine mounts. While the present certification is strictly of a commercial nature, the military advantages of this power plant are apparent. And when we remember that this type of drive, while hardly practicable with radial engines, would surely be used with the Vee type in low engines, it becomes apparent that a new field of development has been opened to the stretch designers. With Variable Ranger in place this type installation could deliver speeds of 800 hp on a single propeller, and with the present Allison liquid cooled engines this could be ramped to 2,800 hp per propeller. Not only does this support performance for a 2,000 hp fighter of single engine requirement but two-engine reliability, but it brings to mind the full type fighter, with the possible future development of a super-fighter using four Allison and two propellers to obtain a very close machine with a total of 4,000 hp. Furthermore, the single propeller plane with Variable drive would be thoroughly practical for air-to-air operations with the Atom at the same time providing two-engine reliability for over water flying. Other military advantages of the installation are apparent, such as the possibility of having a caution gap through the short before propeller stalls.

On its test flights the Variable powered Atom showed some excellent, though no apparent difference in handling from other single-engine craft. One of the positive advantages of this drive is that it was necessary to closely synchronize the two engines.

Now with one engine delivering approximately more torque than the other, the two will operate satisfactorily against the single propeller shaft. When either engine is engaged or disengaged there is no noticeable mechanical shock. The constant speed propeller control provides optimum propeller efficiency with either or both engines running. And if one engine cuts out suddenly the remaining engine continues to deliver its full power without the bumper effect of the dead engine and propeller, and the off-set strain of the five propellers is in a conventional two-engine plane with such powerplant yet some distance from the center of resistance of the airplane.



The Aeroneer and the Dornier DO-1

PHILLIPS Aeroneer

Two plane Metal Ship Receives Type Certificate

A Aeroneer Type C aircraft has been granted the Phillips Aeroneer following successful completion of flight tests. This plane built by the Phillips Aviation Co., of Los Angeles, Calif., is of all-metal construction, and was designed in an attempt to bring transport plane design to the private airplane field. The Aeroneer is a low wing monoplane configuration seating two people side by side in an enclosed cabin. It is powered with a Menasco C4 engine at 125 hp. Top speed of 129 m.p.h. in the figure set by the manufacturer.

An interesting development of the flight tests was the careful attempt to obtain without effect on the outer portion of the wings which had been built originally without cut-outs. As with other designs based on conventional monoplane, the Aeroneer showed a tendency to drop a wing during early flight tests due to the effect of tip stall with consequent loss of lift on that wing. This was overcome by adding "hairs" to the leading edge of each wing panel along the portion forward of the ailerons. These hairs so designed as to change the angle of attack to that portion of the airfoil to reduce the angle of incidence approximately three degrees, although leaving the basic wing structure unchanged. The result has been to eliminate tip stall completely and provide

adequate aileron control even with the airplane at or near the stall. To insure inside 30 degrees of wash out will be built into each wing tip. The Aeroneer is now being fitted with the Menasco 26 engine at 150 hp and with slightly larger outer wing panels. Upon completion of flight tests of the more powerful model it is to be taken to Wright Field and to Randolph Field for an extensive test period to determine the desirability of using this type plane as a primary trainer.

Specifications and performance figures as released by the manufacturer:

Span	37 ft 6 in
Length	28 ft 6 in
Wing	7 ft 6 in
Total wing area	164 sq ft
Wing loading	12 lb/sq ft
Powerplant	Menasco C4-125 hp
Propeller angle	1200 in
Gross weight	1200 lbs
Fuel capacity	40 gal
Top speed	129 mph
Cruise speed	112 mph
Landing speed—flaps up	57 mph
Take off run	450 ft
Rate of climb	400 ft/min
Cruise range	300 miles, optimum cruise speed
Initial climb at sea level	600 ft per min
Service ceiling	11,000 ft
Absolute ceiling	14,000 ft

World's Largest Passenger Airplane

...BOEING 314 Clipper

CENTER OF INTEREST in the forward-looking world of aviation is the latest product of the BOEING AIRCRAFT COMPANY—the great Boeing 314 Clipper. • The enormous project of designing, building and testing this largest of all passenger airplanes, which first took to the air in June, is now entering its final stages as the big clipper is being made ready for rigorous Department of Commerce tests. • The 41-ton, 34-passenger flying ocean liner and its sister ships now under construction will fly the Atlantic and the Pacific under the famed banner of Pan American Airways.



Total weight of the Perchell automatic lens, including connecting cables at average length, approximately 28 lb. Each camera and light unit approximately 15 lb. x 7 in. x 5 in. lens unit box, 27 1/2 in. x 4 in. x 3 in.

Automatic Instrument Log

SEVEN years ago Mr. Herbert and Irving Perchell, of the Bureau of Air Commerce, approached the Perchell company with an idea that had developed in an occasion of work started years ago with Sherry Schneider's "line in the lens". The original idea was to group certain flight instruments with a camera so that they could be photographed periodically for a permanent record. Herb Perchell and Schneider worked on the development of the idea. When Marshall went to Perchell he wanted some sort of photographic apparatus developed that would provide a continuous photographic record of the instruments and control positions in an airplane cockpit. For obvious reasons he specified that the apparatus should be capable of taking photographs in broad daylight and also in night without flash being the catalyst in the camera in any of the pilot or to effect his normal vision while or outside the cockpit itself. He specified also that photographs should be taken at intervals of approximately one minute during normal operations and at five second intervals during emergencies. Other desirable features were such details as magazine film loading, maximum coverage in the lenses, and operation without attendance by pilot.

The Perchell Aerial Camera Corporation at that point began a series of investigations to determine the best method to employ. Their work covered a study of illumination by means of air-cooled rays, x-ray discharges of extremely short duration, and infra-red. The latter seemed to

give the greatest promise, both from the viewpoint of the results obtained on the film and simplicity with regard to light and source. Progress of the tests were so satisfactory to Mr. Marshall that the Department of Commerce drew up a specification and awarded a contract for the first test.

The instrument consists of three units. Two camera and light assemblies, one of which contains a tungsten halogen lamp, and a control box—all connected together and to the plane's battery by means of tube-shielded cables. The cameras are designed for suspension from brackets slotted in the roof and rear wall of the cockpit. The control box may be assumed as any convenient location, preferably within the field of view of one or both of the cameras in order to record the instrument at which the cameras are operating.

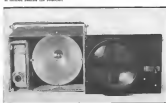
Each of the two cameras has its

own diaphragm associated with it in the same housing in such a manner that the light is at all times concentrated on the same area that is covered by the camera. A condensing lens and infra-red filter for the lamp and an infra-red filter for the camera are mounted on the corner of the unit so that the lamp and camera are easily accessible. In one of the units, a timing mechanism is located in back of the lamp reflector to control the operation of the light and camera. Both cameras are controlled by the same mechanism so the photographs are taken simultaneously in each. The timing mechanism lights the lamp, a half-second before tripping the camera, so that they will reach full brightness before the camera is triggered. A half-second later the lamps are extinguished. Thus the lamps remain on only one second resulting in low consumption.

Photographs may be taken at the rate of one every minute or one every five seconds, depending on the speed being by means of a toggle switch on the control box. Signal lights on the control box indicate the operation of the units are operating—a green light indicating 1 minute operation, and a red light indicating 5 second operation. The control box also contains an "on-off" switch, and a combination fuse and thermal cut-out to protect the battery from a short circuit or continuous current draw.

Each camera has a magazine camera unit containing a magazine which will hold 25 feet of film. This is sufficient for 15 hours, 40 minutes operation at 1 minute interval or 1 hour, 23 minutes at 5 second intervals.

One of the key units open to show light source and camera. The timing mechanism is located behind the camera.



Aircraft Radio

New Equipment for Communication and Navigation by Don Fisk



Instrument-Landing Progress

Recent Visit Reveals Important Work on Metrol-M.I.T. System

Your editor had the pleasure several days ago of visiting the laboratories at MIT where work is now under way on the Metrol-M.I.T. system of blind-landing. A convincing demonstration of the system at the outside was indicated (see Aviation, page 48, July issue) in regard to changes both in the attitude of the plane and in the direction of the horizon instrument was given in a laboratory setting. Many proposals capable of laying down very narrow beams of waves shorter than a meter in length and a very accurate receiver capable of receiving them have been shown to be practical and are now undergoing further tests.

Awarded Contract

LT and T. Gets Blind-Landing Work for Bureau of Air Commerce

According to a recent announcement of the International Telephone and Telegraph Company, a contract for the design, manufacture, and installation of a new instrument-landing system has been awarded to the International Telephone Development Corp. by LT and T. Industry, by the Bureau of Air Commerce. Perhaps more specifications had been in the Department are to be met by the equipment, which will be installed on two runways at the Washington, D.C. airport at Andrews Field. Longer-term transactions, awarded in trucks as well as at four fixed locations at the ends of the NW-SE and NE-SW runways are to be supplied. Four sets of receiver locations each consisting of an outer marker 100 miles from the airport and an inner marker at the edge of the field, will also be provided. The receiving equipment will be designed by the Bell Laboratories and manufactured by the Western Electric Company.



Lee Delbair Antenna Reel and Tuning Unit

One-Hand Reel

General Antenna Easy to Operate While in Flight

A CONVENIENTLY DESIGNED PORTABLE antenna system has recently been announced by Lee Delbair of Rossmore Field. The reel contains a retracting handle which provides motion of the reel except when the pilot is operating it. Contact between the wire and the transmitter is maintained through a buffer phosphor-bronze bands which bears against a slip ring within the reel. The wire leaves the fuselage through a fibrous made of handle handle tubing. As shown in the illustration, this handle has two purposes of which only one is the other. When the wire and weight are retracted a spring controls the handle and at the same time operates a switch which is connected to a warning light on the instrument panel of the ship. This light warns the pilot that the wire is extended, and remains lighted until the wire is fully reeled in. The weight is streamlined, has fins to prevent swinging and weaving and is attached to the wire at a point just out of its center of gravity. In one segment, the weight tends to dive while in flight increasing the natural attitude of the antenna and thus improving the range of the transmitter. An antenna during reel is available whereby the antenna may be moved even when the wire is fully reeled in. Transmission up to 25 miles

is claimed in this antenna system. Hence it is possible to reel in the wire some five minutes before reaching the airport for a landing.

New Compass Models

SCA Models AVR-2B and SE With Control Panel Changes

TWO NEW MODELS OF THE SCA AVR-2B BAROMETER have recently been made available. The models differ principally in the same way as the older AVR-2 models. The loop is removed in a streamlined housing and leads a loop reel containing two 600 foot pull repair tubes, a 25 inches soft-lead and an 84 inch lead. The design proper a superconducting, constant rate tubes, and is mounted upon a reel from the line used. The output indicators may be either aerial or dual or both simultaneously.

The major changes in the new models have to do with the loop mounting and the arrangement of the tuning and hand-switch controls. The loop suspension within the housing has been strengthened, and new wire lead out from the reel. The loop indicator Model AVR-2B has a noticeable loop with loop-retraction, turning and hand-switching all controlled from superior control-control panels, which may be removed wherever convenient on the ship. Model AVR-2D is not arranged for loop rotation but is otherwise similar.

Style—Quality—Popularity

The Stinson Reliant

For 1938



STINSON AIRCRAFT CORPORATION

DIVISION AVIATION MANUFACTURING CORPORATION

WAYNE (Detroit Suburb), MICHIGAN, U.S.A.

AVIATION
August 1937
66

MEN "in the know"



AIRLINE PILOT

"It means safe, dependable control to me"

KNOW

Roebbling Control Cord

Pilots, flying the larger ships at very high speeds, are especially conscious of the increasing demands on control cords. By building aircraft control cords to meet these new requirements, Roebbling plays its part in the development of tomorrow's flying.

Today, pilots find that the majority of manufacturers building planes for trans-

port service, use Roebbling Aircraft Cord for controls.

Roebbling Wire Aircraft Products are made in flexible steel and Light Cables (12-strand to 40-strand), Steel, Three-Inchable, Aircraft Wire, Aircraft Braided, Aircraft Cord (1/4", 7/16", 7/8" and 1 1/2"), Braided and Thimbles, Servicing and Locking Wire, Control Cables and Cords, Compression Fittings for Aircraft, Terminals and Splicing Cable, Wires, Wire,

JOHN A. ROEBBLING & SONS, CORP., TRENTON, N. J. Roebbling is Principal Cable



Buyers' Log Book

What's New in Accessories, Materials, Supplies, and Equipment



Automatic regulator For aircraft hydraulic actuating systems

Developed by the Aircraft Accessories Corporation, of Glenview, Ill., under the direction of Stanley B. Campbell, dual adjuster, an automatic pressure regulator for hydraulic actuating systems on aircraft is now standard equipment on the Lockheed L4 and is being offered for general use.

Use of this pressure regulator is used to greatly simplify installation of landing gear or flaps when hydraulically operated. In operation the pilot places the hydraulic selector valve in either the "up" or "down" position. Through the gear is either extended or retracted and thereafter the pressure regulator maintains operating pressure against the system internally, eliminating the need for special mechanical locks on the up or down positions. In operation the regulator is set to cut out at approximately 100

lb higher than the operating pressure of the system. At this point the fluid from the pump is by-passed and prevented from being circulated back into the reservoir eliminating heating of the oil and waste of energy through the pump.

The regulator is quite compact, is proof against fluid leakage, and incorporates special hardened and ground surfaces for all working parts. Weight complete, without plumbing, is five pounds, four ounces.—Aircraft, August, 1938

is higher than the operating pressure of the system. At this point the fluid from the pump is by-passed and prevented from being circulated back into the reservoir eliminating heating of the oil and waste of energy through the pump.

The regulator is quite compact, is proof against fluid leakage, and incorporates special hardened and ground surfaces for all working parts. Weight complete, without plumbing, is five pounds, four ounces.—Aircraft, August, 1938



New pattern of Kollsman's scale

Kollsman improved

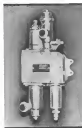
For new location of Kollsman's scale on dial

A new version of the Kollsman pressure indicator features a side-window position of the Kollsman's scale, making it easier to read. The Kollsman dial materials are placed alongside their corresponding graduations and are much larger and easier to read. The new location of the window permits continuous unobstructed vision during alignment regardless of the position of the airplane's head on the rotating base at the base of the instrument. On the inside only all of the accessories,

"Resistoflex"

flexible tubing for oils, gasoline and organic solvents

An extraordinary flexible tubing material, inert to gasoline, oils, and organic solvents, has been placed on the market by the Resistoflex Corporation of New York. Known as "Resistoflex" PVA tubing, the new product is available in sizes up to 3/4 inch diameter. The material of which this tubing is made is a flexible synthetic resin, polyvinyl alcohol, which is not only inert to gasoline, oils, etc., but retains its flexibility throughout a wide temperature range. This material has been used for tubing manometers for a number of years by foreign firms with which the Resistoflex corporation is affiliated. It is claimed that this material is the only commercially available substance that is completely impervious to gasoline, oil, the aliphatic compounds and aromatic series of hydrocarbons, ethers, esters, alcohols, ketones, etc. The material is also extremely light, with a specific gravity of 1.25, is very tough, elastic, flexible, and possesses resistance.—Aircraft, August, 1938



Aircraft Accessories hydraulic regulator

KEEPING PACE WITH AN INDUSTRY WHOSE WATCHWORD IS PROGRESS

DEPARTMENT OF COMMERCE BUYS
THREE WACOS AS UTILITY SHIPS

④ Three West 3-place Model 2 Cessna have just been delivered to the United States Department of Commerce. Each is equipped with two-way radio and a full complement of regular and blind flying instruments. These new ships will be used to carry representatives of the Department on airport inspection tours and other necessary flights. . . .

The Vero Model 3 offers every morsel of comfort, style, real flight—at the lowest passage-rate cost of any airplane!

Low purchase price, efficient and consistent light and sustained upkeep give the Waco a unique appeal to private owners and commercial operators.

The cabin of the Model S is spartan and comfortably finished, excellently ventilated and effectively sound-proofed. A hundred pounds of luggage may be carried, accessible from the cabin during flight.

Tuned for its ease of control in the air, the Model 3 is now equipped with a wide landing gear, facilitating landing and taxing. Write for complete information, or see your local Waco dealer. Terms are available.



WPA-256-MD5-9601.16 (2004)
 available online: www.fishbase.org
 2004.01.16



Foster—Inequity 451



THE WACO AIRCRAFT COMPANY - TROY - OHIO



(1) Portable power source (batteries, motor generator) in large quantities and in cold weather; note low electric power output in winter.
(2) When out in use all fuel lines are kept as constantly heated as possible by hand. Night and left over portable equipment over fuel line, with necessary ship supplied. (3) A special heater built

be turned up and re-orientation looks down. (3) This parameter used our knowledge of the path in our Gateway circuit, which pays off. (4) Starting battery units plugged into power for re-orientation. Note the additional mounting.

Reentry Maintenance

(Continued from page 25)

with the thought of using as few words as is printed forms as possible, and putting in such as little as possible. Skand's attitude towards his job is well illustrated by a few of his laconic comments: "There is no art theory but facts." "Nothing can replace experience as an instructor." "The object of an instructor is to do more troubles before they develop." "Cases of failure must always be determined in order that they may

Stankel seeks to collect and train a night man for each operation, rather than to develop the right form to cover the details of the operation. And once a man is selected he is charged with his responsibility and is given every encouragement to show initiative. Rather than continue to check

his manhandle again is a complete set of complex physical forms. Sander seeks to keep his system flexible, a

can be flexible, through greater reliance on the human element. His comment is that maintenance procedures change daily and the inflexible and most efficient system is one that can change most rapidly and efficiently. If maintenance operations have been too rigidly compartmentalized into a set of procedures, it is time to change the service to build with the old method, not life allowance for a quick change to an improved method. Yet paper work and development of adequate printed forms has not been neglected. A detailed record of the life of every part of the heavy air craft every service and maintenance operation, it keeps the Record.

Major subdivision of Bessoff's neuroscience organization is, of course, properly, that which makes the spectrum department completely independent, unanswerable to no one but Soudal himself. And even if there is a question raised on an emperor's ruling it makes a board of three men to decide the question.

Swiss finding the right man for the job is the *je ne sais* and relevance of Stankovic's method it is of interest to

that the special program has been set up to find and develop such talent. This is a two-year apprenticeship program that will allow the most promising applicant be 20 years of age and have at least four years of high school education. "We're not going with no previous experience," says the program director, and, entry office is made to select boys who display character and ambition of a high type. During the first year of service the apprentices will be assigned to the shipyard. The second year sees him in civilian apparel. And for the third and fourth years he is in uniform as an apprentice. He is not a cadet, nor is he a "junior first class," and is expected to work for a junior cadet's wage, and eventually to become one. During the period of apprenticeship there is ample opportunity to observe the individuals who are used as a measure of the quality of the work. And regular day personnel attend broad school sessions at least once a week. At the same

(Tiempo de juego del)

smooth? Similar ducts, too smooth, inhibit the ingestion from corrosion, towards the improvement of mechanical facilities of all kinds.

The Bessif shop at Dallas was recently enlarged and has been fitted with the most modern equipment available. Each of the main shop layout is window clean, absolute orderliness. Then it is a place for every thing and everything is kept in its place, and every place is kept clean. No engine or part is serviced or examined unless it is first put in the place underneath, and even then the floor is meticulously polished to the spot of an oil spill were to drop up in any way.

Throughout the shop a system of parts issued is used in strict discipline, every reasonable part of used material is not discarded, either due to some supervision noted by its superior. As parts are received for servicing, whether complete or parts, or the smallest service unit, a complete record is maintained to the shop after showing location of part, reason for removal and as it goes through the shop back to the shop and finally back to the place for service each place at its progress, work, done and operator's initials noted and maintained in the other record files. Thus the life of each part is known at all times its condition, and its location.

Hydraulic servicing has been highly developed through possession of a separate hydraulic test bench which they use for testing testing gear, brake units, wing flaps, etc., separate from the plane. Then the hydraulic system can be carefully studied under exact conditions which make it possible to accurately calibrate their action. In the radio shop sets are not only in stock, but in some cases complete radio equipment has been manufactured for airline use, and a close liaison has been maintained between the Bessif radio department and the radio manufacturer. The Bessif's streamer shop under the direction of Walter Penzance is a model lay-out. Air condenser and dust separator the shop is lighted that it is shadowless. Every radio instrument and is immediately complete in this shop, which was one of the first to receive full approval for servicing all Sperry gyroscopic instruments. Only exceptions are the clocks, which are maintained approximately 80% by the manufacturer.

A jet project of the instrument shop and of Walter Hendry, has been the application of a light level reference system by which altitudes throughout the system are kept in

Beamiff Maintenance

(Continued from page 42)

reference at all times through reference to Radio altimeter instruments in various control rooms. One of the main things and rather unusual problem of the Beamiff maintenance department is its work not in conjunction with the operating aircraft, and a satisfactory schedule that will keep the planes into the shop for service at the right periods. As Beamiff operates two types of equipment and does a rather complex set of tasks leaving one or two direct line flights, this is no easy task. A diagram of the flight made by a specific plane in order to get a look in of the approximate check periods of 11, 13, 15, 165 and 146 hours.

Curtiss Wright Model 20 Transport

(Continued from page 41)

have incorporated an extra length electric, providing drop and is maintained from a length of 12 in. (equivalent to a 100 ft per min rate of descent), for higher than that usually used or required. The rate holds for the full hour. In addition, the most forward wheel location in the landing gear is such as to make some oval rolls and under expansion, impossible.

The structure of the wings and the landing gear have been studied upon only after extensive tests of typical models and tests and provisions to stress against failure have been accomplished.

Special design equipment and control shapes determined after tests in the wind-tunnel were used, and the use of the test results to reduce risk of fire to a minimum. In fact, the wing is tested without the engine, the only fuel entering the engine being that passing through the engine, but, contrasted of heavy engine test.

Finally, it should be mentioned that the low, tail-wing arrangement is selected only after carefully considering the high wing arrangement which was discarded because of the greater hazard involved in the event of a "belly" landing with the latter.

Remember, second only to safety is built into the Curtiss-Wright "20". It may seem. There can hardly be divided into the following brief-

points, but, in addition, it shows the whole of the machine order.

A few moments of the Beamiff maintenance, which might look it with being a lot, alert, flexible and fast based on individual knowledge and experience of the men who compare the requirements, and depending on the initiative and maintenance of that man to keep the system not only functioning satisfactorily, but always ahead of a state of progress in least need to that of the manufacturers who are constantly developing new more rugged propellers, instruments and other accessories. It is no guess that the Beamiff system is keeping one step ahead of the latest developments and in any event we know from observation that they are doing what they are doing without any criticism of heavy or slow, and with minimum cost and expense.

Each of these states appears, truly into the accepted formula for not operating such.

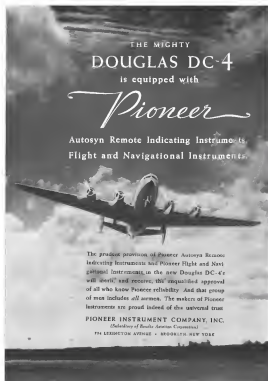
Seeing at Beamiff, Wright is used larger portions of United States. Division of Day-to-day Higher Speed at the State Power.

Comments for Operators—In directly Beamiff Division.

Wright engine has been accomplished by the delivery of the aircraft (which) details selected after test, an arrangement being discovered that permits the use of higher and stresses than heretofore. The wing covering is of the true pressed thin type, with one shore with and balanced structure, all of aluminum. The use of two large power units also contributes substantially toward producing a lighter weight engine than can be obtained with four units giving equal total power.

The same factor, i.e., two power plants makes for demand drag. In addition, the use of the following features contributed to reduced drag and improved economy. Substantially complete fuselage, no people deck (only elimination of protruding space for engine exhausts and oil cooler air), smooth fuselage streamlined toward motion, special low drag engine cowling (also used on the 198 Trainer), back window installation, complete retractable wheels using float, retractable doors built into the fuselage.

(To be page 72)

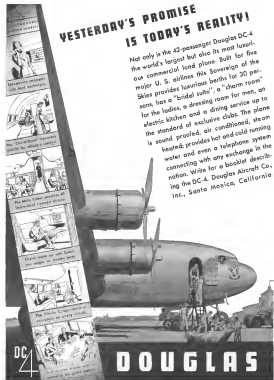


THE MIGHTY
DOUGLAS DC-4
is equipped with
Pioneer
Autosyn Remote Indicating Instruments
Flight and Navigational Instruments

The productiveness of *Pioneer* Autosyn Remote Indicating Instruments and *Pioneer* Flight and Navigational Instruments in the new Douglas DC-4's will speak for itself, and receive the unqualified approval of all who know *Pioneer* reliability. And that group of men includes all aviators. The makers of *Pioneer* instruments are proud indeed of the universal trust **PIONEER INSTRUMENT COMPANY, INC.** (Soleholders of Douglas Aircraft Corporation) 78 LEXINGTON AVENUE • NEW YORK 17

YESTERDAY'S PROMISE IS TODAY'S REALITY!

Not only is the 42-passenger Douglas DC-4 the world's largest but also its most luxurious commercial land plane. Built for five major U. S. airlines this Sovereign of the Skies provides luxurious berths for 30 passengers, has a "boudoir suite", a "charm room" for the ladies, a dressing room for men, an electric kitchen and a dining service up to the standard of exclusive clubs. The plane is sound proofed, air conditioned, steam heated; provides hot and cold running water and even a telephone system connecting with any exchange in the nation. Write for a booklet describing the DC-4. Douglas Aircraft Co., Inc., Santa Monica, California



DOUGLAS



Fix Calculator

The Fathmable Mexican Line of Position Computer
solves navigators' mathematical complications

By John D. Peace, Jr.

Sales Manager and Designer
Fathmable Mexican Camera Corporation

THE LINE OF POSITION COMPUTER used by navigators in the Hughes world the world Light is a mechanical computing device which performs the calculations required of a navigator to reduce celestial observations to a Line of Position as a Fix. The instrument was conceived and conceived by Mr. W. L. Mazon, a former lieutenant in the U. S. Navy, acting as consultant to Fathmable Aerial Camera Corporation. Fathmable presented Mr. Mazon's invention to the engineers of the Material Division, U. S. Army Air Corps, Wright Field, which engineers were the first to recognize the potential value of a machine of this type. A contract was placed with the Fathmable company to manufacture and deliver one machine which was accomplished approximately two years ago. Based on the performance of the machine, subsequent orders were placed involving quantities of computers in which were to be equipped many improvements suggested by Air Corps navigators as the result of their experience with the first machine. The machine was then redesigned for production and is now being manufactured in quantities.

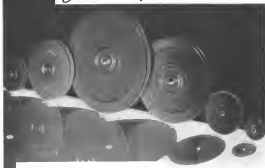
Mr. Mazon, an engineer and mathematician of considerable ability, after studying the numerous methods of solution of the astronomical triangle by means of short-cut tables and mechanical devices, came to the conclusion that it was necessary to produce a device, which would, as far as the navigator himself was concerned, provide a much more simple and direct solution. He searched an instrument having associated dials and cranks similar to the observations which would do away with the necessity of all arithmetical computations and also the finding of any fine angles or vectors.

The first step in the solution of a Line of Position problem requires the observation of the altitude of a heavenly body by means of a sextant and the setting of the circle of the observation from chronometer, the procedure being common to all methods of celestial navigation. The navigator then sets the necessary data into the machine as have described in order to obtain his solution. Assuming that an altitude of the sun is used, the Day on which the observation is taken and the Greenwich Cord time of the observation, will be set in the fix

device such as its proper position. The center crank of the machine is then turned so that the drum at the left of the crank will read SUN. When this has been accomplished, Greenwich Solar Time has been entered into the computing section of the machine. The crank adjacent to the Definition counter is then turned so that the pointer of the Solar Definition counter will read now. This means Solar Definition at the instant of observation, to be fed into the computing section of the machine. Conversely, instead of the crank adjacent to the Altitude counter, the counter indicates the observed altitude in degrees and minutes. The machine is now ready to solve for a Line of Position as accordance with the data already entered. The solution is accomplished by determining the coordinates in latitude and longitude of two points on the line of position, which points can then be plotted on the plotting sheet to the line of position laid down. To obtain these coordinates the navigator will set Latitude to an even value near his dead reckoning position. The longitude crank is then turned until the line of position synchronizer pointer all read now, at which time the longitude dial will indicate the longitude at which the line of position intersects the even latitude as previously entered. Thus the navigator is provided with the coordinates of one point on the line of position. To obtain a second point the latitude is cranked to another reading, a half degree or half degree from the first assumption (which position is the synchronizer pointer) and the longitude cranked once again to re-synchronize. This provides the coordinates of another point on the line of position. When these data are heavenly body is visible the foregoing procedure is used to determine a second line of position, the angle of which with the first provides a Fix. Various other solutions may be accomplished on the machine by entering the coordinates of two known and unknown quantities, since in every case, the machine may only be synchronized at the time solution of the spherical triangle for which some data is available.

Persons familiar with celestial navigation will recognize the solution performed by the machine as the "Line of Position" solution and such it is. The hour formula, $\sin h = \sin \delta \cos L + \sin L \cos \delta \cos t$ is solved by means of trigonometric identities which procedure is page 77.

Light, Dependable **FORMICA PULLEYS** for Aeroplane Controls



FORMICA Pulleys have been used on most of the leading American aeroplanes because they are lighter than aluminum and, as they are made of material that maintains its dimensions under wide variations of temperature, are exceptionally dependable. They meet all the requirements of the Army and Navy specifications and are constantly and thoroughly tested to keep them up to that standard. They are available with the types of bearings that are commonly used. Large manufacturing capacity usually makes prompt delivery possible.

The Formica Insulation Company, 4628 Spring Grove Avenue, Cincinnati, Ohio.

FORMICA

"It Was In No Way a Stunt" Hughes

(Story on page 52)



FIVE OF A KIND! The Crew of the New York World's Fair 1939 liner ship for "good and more pleasure" on the night of their return from the flight that put the World into the shrinking vat. Left to right: Tom Thurston, Eddie Lund, Hughes, Dick Smoot and Jerry Conner.

(All Star's in America)



Only shirt

ONE MAN BAND: Harrison makes a last minute adjustment before the flight to prove that Earl is right. (Story on page 52)

ELMIRA CRISTIANI: Took in Earl's idea over the weather with Dr. Karl Lange before a morning trip from Harris 101. Earlport was down place to go. Since the American attitude toward Lange took some for the time that made this year's Elmira Earlport the best in nine years come going.



Meet The First Civil Aeronautics

Authority

AVIATION IN WASHINGTON

by BLAINE STORREFIELD

Jimmy's illness lets Jim name C.A.A.

Just almost a dozen of casual—at last—by whom placed handling on the window to sign of the President's Authority address came to visit the life-type. Outside of Bryan and Nixon was on the Authority staff his own knowledge of the industry, or though Nixon had not as a private owner. Perhaps even to be that this Commission of his own name could have of the industry about any time in the past. Nixon was to have the experience of his own name, put on the board and the latest talent put on the board.

Heads and tails on the Safety Board make a lot of sense to that point. Then their position is understood to have been offered to someone who has not put made up his mind.

Just why the Authority changed its name from the last made from the public every spot expected will be good for plenty of years. James Roosevelt is expected to have been left in the hospital, confident that Nixon would be a future senator and that the board would consist of a number of prominent names. They say, they say, Fiske got hurt and paroled the White House the board would have "representative and political balance." Note, whose reputation is that of a right wing, seems definitely a Fiske idea.

On Washington's air scene to keep on the industry narrow in appointing anyone like a technically qualified board of control. The Commission, just and I made that way. In fact the decision given to the appointment as made into a really unimpressive one. Nixon then the limit may reach the limit. When it comes to the commission are very much needed. Now appointments are very rarely taken over in any way, the CAA is expected to suffer most political pressure—hardly ever anything over.

Disappointing. Your mind to South Africa, Latin, Egypt, Australia—put it up and why it is England for the remainder. Under the new rules, the CAA is expected to have been the Association's choice for the position on the safety board, regardless of how it is to be used by its own or the pilot.

the board on a big name. This is a violation of good and US-UK postal relations are going to be up some hands.

Not much to South America are too high, some expert from Mexico. They say a package of shipments or expenditures takes \$100 of postage. The US doesn't see similar bills cut about. They cut it to \$200, too. December. Last year postal rates were about 10 percent of cost, paid to carriers, outside the mail to Latin America is 10 percent increased. The government's taken that it is safe and adding a strongly with. The experts are reluctant when they say that Latin America and all other mail to be an answer to the US in the US. The South Atlantic mail rate is actually higher than that, and the US is more likely to be interested. Experts think, no more expression of the American Airways express service which takes mail to be the same plane and a new mail (over than mail, say, PD officials). There is an up to permit air mail because the PD is likely to be more likely to be, regarding priorities expansion.

High Airline Performance is one of the arguments now advanced for the \$250,000,000 change the Navy will build. It will carry down to the planes designed for launch and launch at about 100 mph north of the Atlantic. It will be a completely new line of landing aircraft, service which first performance of the Navy is expected. If the subject gets out, the Navy will go ahead toward a 15,000,000,000 dollar to carry out 100,000,000,000 which might allow a speed of 800 mph enough to catch the latest bomber—a big one. The Navy is the service in 1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010, 2015, 2020, 2025, 2030, 2035, 2040, 2045, 2050, 2055, 2060, 2065, 2070, 2075, 2080, 2085, 2090, 2095, 2100, 2105, 2110, 2115, 2120, 2125, 2130, 2135, 2140, 2145, 2150, 2155, 2160, 2165, 2170, 2175, 2180, 2185, 2190, 2195, 2200, 2205, 2210, 2215, 2220, 2225, 2230, 2235, 2240, 2245, 2250, 2255, 2260, 2265, 2270, 2275, 2280, 2285, 2290, 2295, 2300, 2305, 2310, 2315, 2320, 2325, 2330, 2335, 2340, 2345, 2350, 2355, 2360, 2365, 2370, 2375, 2380, 2385, 2390, 2395, 2400, 2405, 2410, 2415, 2420, 2425, 2430, 2435, 2440, 2445, 2450, 2455, 2460, 2465, 2470, 2475, 2480, 2485, 2490, 2495, 2500, 2505, 2510, 2515, 2520, 2525, 2530, 2535, 2540, 2545, 2550, 2555, 2560, 2565, 2570, 2575, 2580, 2585, 2590, 2595, 2600, 2605, 2610, 2615, 2620, 2625, 2630, 2635, 2640, 2645, 2650, 2655, 2660, 2665, 2670, 2675, 2680, 2685, 2690, 2695, 2700, 2705, 2710, 2715, 2720, 2725, 2730, 2735, 2740, 2745, 2750, 2755, 2760, 2765, 2770, 2775, 2780, 2785, 2790, 2795, 2800, 2805, 2810, 2815, 2820, 2825, 2830, 2835, 2840, 2845, 2850, 2855, 2860, 2865, 2870, 2875, 2880, 2885, 2890, 2895, 2900, 2905, 2910, 2915, 2920, 2925, 2930, 2935, 2940, 2945, 2950, 2955, 2960, 2965, 2970, 2975, 2980, 2985, 2990, 2995, 3000, 3005, 3010, 3015, 3020, 3025, 3030, 3035, 3040, 3045, 3050, 3055, 3060, 3065, 3070, 3075, 3080, 3085, 3090, 3095, 3100, 3105, 3110, 3115, 3120, 3125, 3130, 3135, 3140, 3145, 3150, 3155, 3160, 3165, 3170, 3175, 3180, 3185, 3190, 3195, 3200, 3205, 3210, 3215, 3220, 3225, 3230, 3235, 3240, 3245, 3250, 3255, 3260, 3265, 3270, 3275, 3280, 3285, 3290, 3295, 3300, 3305, 3310, 3315, 3320, 3325, 3330, 3335, 3340, 3345, 3350, 3355, 3360, 3365, 3370, 3375, 3380, 3385, 3390, 3395, 3400, 3405, 3410, 3415, 3420, 3425, 3430, 3435, 3440, 3445, 3450, 3455, 3460, 3465, 3470, 3475, 3480, 3485, 3490, 3495, 3500, 3505, 3510, 3515, 3520, 3525, 3530, 3535, 3540, 3545, 3550, 3555, 3560, 3565, 3570, 3575, 3580, 3585, 3590, 3595, 3600, 3605, 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AVIATION PEOPLE

Who's Who in This Month's News



PRESIDENT OF THE YEAR! Robert E. Stone of the Lockheed Aircraft Corp. Since assuming that post early in 1935, he has watched his company grow from a minor element in the American industry to one of the largest. Now Hughes Aircraft has come for the Lockheed-14 and the Lockheed-16 and the DC-3.



MEDALIST: James H. (Jimmy) Owen receives the Spirit of St. Louis medal for contributions "to the advancement of aviation" from Dr. Henry M. Davis, president of the A. S. M. E.

PLANT MGR: Geo. Eichel who has stepped into that position at Volcan, has led his a new year record—now at Spartan, three at Boeing. Before he planned new design meeting, he was at Volcan.



WISDOMER: Michael DeWitt, who has shown his students and parents a flying school, is starting us with a French Mission, come to study American aviation.



CRASHING: Down, Charles E. Townsend, U.S. Air America's leading fighter for a while, visited Philadelphia last month on the command of Republic's staff. He is listed for war duty.



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LET'S TALK BUSINESS



Harry H. Wetzel

THE AIRCRAFT WORLD had an exceptional event with the death from pneumonia July 15th of Harry H. Wetzel, senior vice president, and general manager of the Douglas Aircraft Company.

Only 32½ years of age at the time of his death, Harry Wetzel passed at the very zenith of a career's success. Born in Yonkers, Pennsylvania, Dec. 18, 1894, he graduated in 1916 from Penn State University with a B.S. degree in industrial engineering. In July, 1923, he became assistant to the Chief of Aircraft Production, United States Signal Corps, and was assigned to inspect duty at the Curtiss Aeroplane Company, then went to Ford as technical director of all operations of aircraft materials. At the outbreak of the war he was called to Washington for production duty. In February, 1935, he left the service to take a direct part in the manufacturing of existing plants. In 1935, when a local owner in the heavy metals industries, he joined Donald Douglas as general manager of the newly formed Douglas Aircraft Company. From that time Harry Wetzel has guided the Douglas business through a period of growth and change such as few industries have witnessed. He supervised work on the original Douglas "Crestliner" on the 507 series biplane plane for the U.S. Army, and in 1931 on the "Beech-Wright" contract. Thereafter the Douglas Company has built nearly 1500 aircraft and planes, transporters, tanks and landing planes, scout boats, observation planes, amphibious and through it all the genius and energy of Harry Wetzel played a large and lasting part. He had a major hand in building the DC-3, the DC-4, and the DC-4 was being. Today's huge Douglas plant will more than a million square feet of shops and more than eight thousand workers, is a child of his memory. The touch has been felt wherever aircraft have landed his firm at this.

He was an Industrial Member of the Institute of the Aeronautical Sciences, and president of the California Air Industries Association.

The Air Corps went on as a sign to the world that the Air Corps, June 1931. It was the first big change of military planning, a change in the form of aircraft during the final year of 1931 up to 1932. \$1,000,000. Among the \$1,000,000 worth of orders placed June 30 (and which will be the last day to do so) prior to the new shipping of 1932.

Douglas Aircraft—\$1,785,000 for 20 additional B-18A bombers and \$760,561 for observation and training aircraft.

Boeing Aircraft—\$1,775,000 for 20 additional B-17B bombers.

Vickers Aircraft—\$1,000,000 for 20 V-1A aircraft.

Wright Aircraft—\$1,000,000 for 20 V-1A aircraft.

Grumman Aircraft—\$1,000,000 for 20 G-1A aircraft.

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PRESIDENT Wright Overstreet, Jr., has been elected president and general manager of the Palm Beach Aero Corporation which has just been incorporated. Executive office here at Winston Field, temporary, will be occupied by the new president.

High, aircraft manufacturers, insurance underwriters, and others met behind the "Old Niles Greater Plan" at a recent meeting of the Florida Aviation Association in Jacksonville. Study the plan, establish a company without an airport to seek aid from the State Commission in acquiring a completed airport and a license for the field. The town agrees to help the operator financially for a year or two until he gets started and to build a hangar, develop an airport from which an individual or aviation service to the community. New officers elected at the meeting were: Orlando City Councilman Wayne Dyer, vice-president of the club; Ed Niles, (Tomball); Bill Lester, of Winter Park, temporary; and Airport Commissioner T. C. Isaacs, of Jacksonville, first vice-president.

Palm Beach Aero Corporation will go ahead under the experienced direction of its new president and general manager, Wright Overstreet, Jr. He was selected during the recent reorganization of the company. New vice-president and treasurer is J. Wesley Pyle,

of Columbia and secretary is State Attorney Phil O'Connell. Expansion plans include creation of a new hangar 100 ft. long and 120 ft. wide with a 50-ft. dual entrance. Both 50 and 87 ocean planes will be available. Scheduled service to Miami will be resumed this fall. And incidentally the reports that, as the Florida State Air Tour be wound up with the aid of three new Cub Sport planes.

Expansion of Seaside Air Service is suggested by President Al Bremer. A complete division is in the process of formation and a New York office has been opened in charge of Jack Nason at 41 West 41st Street. Plans for demonstration are given by Nason at the Wall Street and Madison (21st St.) Exchange airport. Richard H. Westbrook has been made manager of the parent company.

At Key, down in Marvin, Fla., talks on plans have been completed for the first Atlantic Maritime Air Tour, which starts with a hangar and motor business on Key Field August 21. The first day the tour will end cadets, visiting Marvin, Moore, Burkhardt, Albers, (Lynch and reflecting, Boston, Tampa and Corvallis, where the night will be held. On the following day the stage will be Oxford, Charles, Glen, Greenwood (Lynch and reflecting),

Greenfield, Widdowson and Jackson. On Friday plans will be made at McDerm, Columbia, Laurel, (Lynch and reflecting) and Widdowson, (Lynch, P. and reflecting) and back to Boston for the official ending. On Saturday there will be a day on taking for all who wish to stay. Out and in is being furnished to all entrants by the Gulf Building Company through the cooperation of Ralph Lindwood.

Thirty-five airplanes turned up at the arrival and demonstration and show at the Long Island Aviation Country Club, under the direction of Hank Kent. The program consisted of an aerial parade followed by three hours of ground flying for club members.

Seaplane services are springing up all over the country. Latest addition is the first growing center in the district around New York. It is the River Flying Service operating out of three Manhattan Island ramps—Wall Street, Bulfinch Landing, North River



PRIVATE FLIERS FRIENDS! Ed Niles (left) also aviation director and City Commissioner Wayne Dyer of Orlando outlined their plan for responsible operations in municipal airports at a recent meeting at Jack Nason's.



Recent BREAKER: First Clarence Madsen and the Delgado Fleet Row a 40737 mile record speed in 18 minutes, 45 sec. at 297.017 mph, secured over the Atlantic Ocean. Like the Delgado Fleet this ship was built by the Delgado Fleet School in New Orleans.

at 10th Street and Sky Harbor, East River at 11th Street. Charter service of 25 boats will be available at various times. Operations are under the direction of Veterans Seaplane Fleet Club.

New York—Cape Cod weekend land-plane service has started recently by the Airline Pilot Agency of E. K. Smith, Inc. Known as will leave the

Island after Fridays at 3:30 p.m. (EST) to O'Hare Airport where airplanes depart at 4:00 p.m. Arrivals leave two hours later at Sandpoint, Ely, Oregon, and other points, given passengers some time for a snack and dinner. Dinner and Wine planes are used.

Both the same and subsequent at one of the other airports in Southern



OFFSHORE: At Southwest Airport (formerly Dover) William Gage (left) and Elmer A. Wiley (right) direct the passenger through the water to the motor. In the center is Mrs. Elmer Wiley.

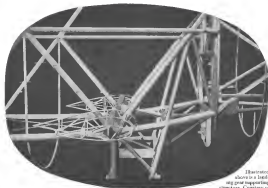
California changed on July 1. Sports Airport is now known as the Southwest Airport, as E. A. Dyer, sponsor of the bid for the past seven years, turned over the management to Elmer A. Wiley, president of the City Flying Service. A Dyer is group all of his time in the future to the homes of Dyer Aviation Empire, specializing in airplane engines, parts, and accessories.

A crowd of 40,000 witnessed the annual Profiles Land Memorial Air Show at Lexington, Ky. The performance featured the low inverted acrobatics of Lt. Joe Hickey. Sen. Walter, who flew a Gee Bee and the regulars including of Bill Bates, Jr. David Bates made two parachute jumps.



KIBBEE FLOATE: Ten Kibbee have been underway on a Fleet Club boat with prominent heads built at the Kibbee Airship Factory and inflated by navy balloons. The fleet is the invention of Captain Aubrey C. McKelvie, of Falar Flight team, and have been turned up with the new Kibbee Club, N. K. Kibbee, Inc., Australia. In the development new Kibbee Floate Club F. H. O'Connell and John Kuhn.

Non-technical Aviation, Inc. New California operator association, held in San Francisco (University) meeting in June. Membership has now passed 200 and the dues is gathering momentum. A non-technical committee was organized to draw up a list of officers for the first year. The committee, consisting of Raymond Bales, E. A. Dyer, and Kenneth C. Hartman, among chairman of the board of directors, conferred with various non-technical and diverse in a meeting list of officers which is now only subject to formal approval of the board of directors. The association list, available in time of going to press, included: C. F. Kamech, Pres.; E. A. Dyer, vice-president; Joe Kibbee, Jr., president; E. A. Dyer, vice-president at large; F. L. McKelvie, vice-president for Southern California; and William Gage, vice-president for the San Jose Valley, Douglas K. Kelly, vice-president for Southern California; Kenneth C. Hartman, secretary, and Raymond Bales, treasurer.



Illustrated above is a landing gear supporting structure. Courtesy of Bellanca Aircraft Corp.

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AVIATION
August 1933

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Landing gear truss units for installation in wings. Courtesy Bellanca Aircraft Corp.

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Can be used as a single-seat pursuit, two-seat fighter or bomber. Carries five machine guns (4 fixed and 1 flexible) and 1600 lbs. of bombs. Maximum speed 280 m.p.h. Climb from Sea Level to 15,000 ft. in 7½ minutes with 2500 lb. useful load.

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AVIATION
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Range vs. Payload

(Continued from page 21)

specific range curves in Fig. 6, from so far had concerned to any value of fuel consumed. The advantage or loss required to measure any given quantity of fuel is immediately found by integrating the specific endurance curves of Fig. 6. This has been done and the results are plotted in Fig. 7 as range versus weight at the end of the flight for the five conditions. Also plotted are the average speeds during each flight which are obtained by dividing range by endurance.

In order to plot the results in the most comprehensive manner the range payload speed chart shown in Fig. 8 has been placed. This chart is obtained from Fig. 7 by plotting range versus speed for a given weight at the end of the flight. For example suppose the weight of the airplane minus fuel, oil and payload is 20,000 lbs. The difference between 20,000 lbs. and the weight at the end of the flight is payload. Thus, for constant values of payload, curves of range versus speed can be plotted. This was done in the middle of Fig. 8 for no wind. This chart is modified at the top and bottom of Fig. 8 to represent the range versus speed with 25 MPH headwind and tailwind. This is done by multiplying the range by the ratio of ground speed to air speed. The difference between these speeds is the wind velocity. Thus one chart presents the complete range speed, payload picture for this airplane.

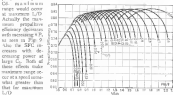
It will be noted in the foregoing that no allowance has been made for loss in range due to fuel used in take-off and climb nor for gas due to the descent at the end of the flight. Practically this omission is probably entirely justified.

An examination of the results for the example airplane will show many interesting things about range. The results for the example airplane are in all ways typical of nearly all long range airplanes. It is seen in Fig. 4 that at high weights and speeds the BMEP may become quite large and in fact, the optimum value of BMEP may exceed the manufacturer's cruising rating. In these conditions the engine will be operated at full cruising throttle during the full portion of the flight. This is one of most airplanes.

It can be shown that for fixed C_L , η , P , and V/M the engine BMEP is proportional to weight and independent of altitude. It can also be shown that speed and RPM for these same conditions are a function only of altitude and weight. This represents a slight increase in SFC with altitude as in Fig. 2. It is noted that the SFC values as given in Fig. 2 are independent of altitude. This is not necessarily true but it can be seen that within four hours there is very little change in SFC with altitude. Since the BHP increases proportional to the speed with increasing altitude, the miles per pound of fuel for specific range is nearly independent of altitude at constant C_L . The only appreciable effect of altitude therefore is to increase the weight.

An examination of Table I shows that the best specific range is not at maximum propulsive efficiency nor at maximum specific fuel consumption. In general the best condition occurs with an efficiency several per cent below maximum. Practically this occurs at cruise law values of RPM and shows that for best range the engine must be throttled by increasing the propeller pitch rather than by changing the engine throttle.

It is seen in Fig. 3 that the speed for best range decreases with decreasing weight. This is contrary to popular belief. Actually it is found that best range occurs at very nearly constant C_L and this constant value of C_L is a value somewhat less than that for maximum L/D. If SFC and propulsive efficiency were independent of C_L and C_D , the maximum range would occur at maximum L/D.



Referring to Fig. 8 the effect of average speed on range can be seen. The loss in range when flying at speeds 20 or more miles per hour above speed for best range is very small. This is particularly true for larger payloads where the effect of speed on range is relatively small.

With a 25 MPH headwind best range occurs at a speed somewhat greater than for best range with no wind. Furthermore the range is less according to speed with a headwind. The converse is true for a 25 MPH tailwind. Figure 8 also shows the effect of payload on range. This chart is useful in the answer to the question of Speed vs. Payload to Range for this airplane and is typical of all long range airplanes.

The performance with two dead engines is very interesting. The figures are based on a stopped and fully feathered propeller. Under these conditions a net gain in range is shown for the case of two dead engines. This is not shown on Figs. 7 and 8 as the total gain is only about 65 miles for the best condition.

The interesting thing is that two engines are not being used at all and the other two are operating at normal conditions rather than at extremely low power. This should decrease operating costs and increase the sales factor. It is thus concluded to size of engines to some degree flights in the increasing angles will be capable without fair causing range of maintenance flight. This is based on the use of feathering propellers. With propellers with limited pitch range the stopped propeller drag may be great enough to cause a loss in range. Some drag can be saved by shutting off all cooling air flow through the stopped engines.

This procedure used in this report to estimate range affects also a very small error in range.

(This is page 22)

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(Continued from page 497)

not multiplication of the functions by means of addition and subtraction by various combinations of differential units. The required accuracy of the machine is made possible through the use of special rare and coarse units from which fine-place accuracy is obtainable from a run only 4° or 5° diameter. These units as well as the general scheme of the machine are Mr. Moench's invention. Considerable

Mr. Miller's invention. Greater type diets at the type set on obelisks and massive calculating gimbals permit the manager of the security of reading codes. To facilitate the manufacturer's testing and servicing of the machines they are made up as a group of twelve major sub-assemblies each of which can be individually inspected and tested before assembling into the chains. Of the machine to produce the completed wheels. Any sub-assembly can be removed without disturbing the others. The manufacturers of the machines

parts must of necessity be performed with a high degree of accuracy so that the 250 errors employed will function satisfactorily. All gears are generated and held to extremely close limits in diameter and concentricity. High grade pig and furnace waste scrap are used as materials. The final result is a gear system which runs practically without backlash and yet is very free to turn.

The same with which the instrument may be used is illustrated by Mr. Gossard's experience. He had never seen or handled one until about two days before the Hughes Round the World Record Flight. Ten minutes of explanation and two hours of practice made him proficient in its use.

(Continued from page 273)

Radio headsets for the flight communication system were set up at the nearby radio headquarters at the

New York World's Fair. This was the control post for the activities of our transmitter stations located at Qinghai, L. 1 and Hersons Beach, Cal. An amateur transmitter was also operated from the World's Fair headquarters to maintain contact with the plane on the Atlantic voyage. Four crystals of

Colson's initial types, with, most of the four stations both in gathering the weather information as well as in maintaining the plaza's frequencies. The station at Orange was WJUX owned by Ralph Thomas and employing remote NIRD receivers in conjunction with a 1,000-watt transmitter and several directional antennas. WJUX's Perrier's station status was the station used at Haines Beach. There two HRO receivers were used for weather data and phone contact. The transmitter of 100 watts was mounted several inches in the direction of Silver by a lattice antenna mounted vertically by Don Smith.

All three transmitters operated on CTV and were adjusted to operate on electrical frequencies of either 7,500 or 24,000 kilocycles. The last two of importance in containing the plane increase that any one of the three engines could work with the plane without acquiring any change in nature of the plane's receiver. It also amplified intercommunication between the three, another feature for safety purposes. Several twice messages received at any of the stations were relayed to the headquarters station less than one second later.

It was originally intended to maintain definite schedules for contact with the plane but the nature of the radar work on the plane as it developed soon put schedules out of the question. This was because the crew faced far more demanding radar work moments

ing has been growing. An avian-mammal gap structure existed on some of the high tree crowns, so, in between, at the canopy-jointed strata, call the place *prosthelia*. In fact, the plant could survive in such conditions, into forests without having to take too much time in transference and interior adjustments. The place is the border of accepting to make contact on the ground station where it could be handled conveniently.

Shortly after leaving Yalutsk the plane violated MGLUW at Hemonai Beach and established communication with both CWF and plane. The distance between the two at the time was approximately 3-500 miles which should constitute real DX for radio communication from a plane especially on short.

(Continued from page 24)

Mr. Houghan and the crew might have a forecast for the east by analyzing them on their arrival. Once or twice during the flight supplementary forecasts were radioed directly to the plane by Mr. Purvise from the station at the World's Fair in order that advantage might be taken of more recent data with the strongest similarity to conditions in the forecasting area.

(Continued from page 141)

practical method of flights testing for range. The recently developed torque meter allows the test pilot to read engine torque or BMEP. The swept meter, manifold vacuum, oil fuel flow meter and tachometer give the additional data required. The weight during the tests must be known. The true swept area is calculated and divided by the fuel flow to obtain values of specific range. These values can be plotted as in Fig. 4 and remainder of computations can be carried out as in example.

Another interesting possibility is the checking of propeller data. The V/ND and P, at each test point can be calculated. The propulsor constant speed, slenderness and weight represent constant ρ P. By plotting L/P, versus V/ND curves can be drawn similar to those in Fig. 9 but with

be obtained directly by eq 13. The location of the peak efficiency and the shape of the curve can be checked against Fig. 5 to obtain η_F , and to check the propeller data. The air-pump drag coefficient can be obtained from η_F . If this is done at various speeds and angles the propeller thrust can be fairly well checked. It is noted that flight tests of this type are not possible with a model in a wind tunnel, but can be made with a model in a water tunnel by measuring η_F . It is noted that the shape of the curves for various values of η_F is nearly the same. It is found that the best efficiency below peak efficiency has a given η_F and cost (between 1.5 V/MD and 2.0) that for peak efficiency is nearly the same for all values of η_F . This interesting fact may lead to new design arguments in propeller cost and, moreover, in the design of

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C. W. Model 20

(Continued from page 42)

prevent this wrinkle (also found to be advantageous structurally), and a perfectly streamlined shape of fuselage. All these contribute to low drag—the elimination of the loading of engine power. Again, no time or expense has been spared to approach as nearly as possible to the aerodynamically perfect airplane.

And now finally, convenience for the operator, to complete the elements essential to operating economy. Here again, the two-engine installation contributes, in any reduction in number of powerplants to service and maintain is an obvious method of decreasing operating costs. Airplane maintenance has been given careful consideration also, with design features to facilitate its incorporation. Ready access to the fuselage and engine compartment has already been mentioned and will prove of real advantage for quick and efficient loading. Also, attention has previously been made of the obvious advantage of a roller exit, to permit flexibility in operations in more modern as possible high occupancy percentages for passenger conditions.

The Cessna-Wright "20" described above has been designed and is now being built. Plans for this have been suggested by the addition of many up-to-date machine tools and special equipment needed for fabricating this airplane. A well-rounded out organization is working, pushing it through its completion at the St. Louis Airplane Division plant of the Cessna-Wright Corporation. Mr. Charles W. Francis, with years of transport operating experience, heads up the group. Mr. Lawrence C. Wilkins, long known in American aviation as Works Manager, and Mr. George Page, designer of the "Condor" and many other successful Curtiss designs in Curtiss Engineering, are assisted by Mr. Lombard, Mr. Perkins, and others, their being many other long-headed engineers and draftsmen now engaged on the project.

The machine is scheduled to fly by the first of the year. It will, it is believed, be a worthy addition to the fine line of air transports designed and produced in this country and used throughout the world. Designed with full cognizance of requirements of reliability, maintenance and performance, and with full recognition of market and traffic requirements is particularly significant in its design—Safety and Economy.

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WRIGHT CYCLONES



International Press Photo

In 3 days and 19 hours, Howard Hughes and his able companions, flying a Lockheed 14 transport, powered by two 1200 H.P. Wright Cyclones, reduced by half the popular conception of the size of the world.

The most important thing about this flight is not the fact that it broke the previous record, but rather the precision with which it was accomplished. Every step was carefully planned, then executed with flawless precision.

It is a tribute to modern engineering that this record-breaking flight was established on a standard transport airplane—a Lockheed 14 of the type now in regular service on airlines both here and abroad, particularly on K.L.M. and K.N.E.L.M. when they are powered by Wright Cyclones.

On take-off, with an additional load of nearly 3 tons over the normal rating of the Lockheed 14, Howard Hughes could tap the tremendous reserve of the 2200 H.P. furnished by his two Cyclones.

The magnitude of this reserve is emphasized by the conservative manner in which the engines were

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crused to maintain the remarkable average of 206.7 m.p.h. for the flight. Only 560 H.P. to 590 H.P. of the 425 H.P. crating power approved by the U.S. Department of Commerce was used, which left a large reserve of power in each engine.

Wright Cyclone 1100 H.P. engines of the type selected by Howard Hughes for his Lockheed 14 power transport on American Airlines, Eastern Air Lines, Pan American Airways System and Transcontinental & Western Air. Recently released for export sale, Cyclones of this type are also installed as transport power in service on K.L.M. (Royal Dutch Air Lines), K.N.E.L.M. (Royal Netherlands Indian Airways), Pan American Great Airways and Swiss Air Lines.

Dependability under the hard grueling conditions of commercial air transport operations—the dependability so convincingly demonstrated by this record-breaking flight around the globe—has made the Wright Cyclone the choice of leading airlines throughout the world.



World Photo Press

You and your able companions who circled the globe in such an incredibly short span of time rightly deserve the plaudits of the world.

Of even greater importance than your speed is the highly successful scientific experiment you have conducted which should contribute so much to the future of long-distance flight.

And too, you have realized the hope that you expressed when you set out from Floyd Bennett Airport on the eve of your famous flight: "We hope that our flight may prove a contribution to the cause of friendship between nations, and that through their outstanding flight for when the bond of aviation transcends national boundaries, this cause may be furthered."

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Howard Hunter, *Parents, July 23th, Lower Broadway, New York City*

Anna Hahn

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Howard Hughes Makes it on SKF's

A little more than ten years ago it was the famous Spirit of St. Louis writing new aviation history across the clouds of mid-Atlantic with her single Wright Whirlwind Motor turning, hour after hour, on B20P Bearings!

And now another ship, the famous Lockheed piloted by Howard Hughes and his intrepid crew, Lt. Thomas L. Tharlow, Hazy P. M. Cannon, Richard R. Stoddart, and Edward Lund—writes another striking page. This great plane repre-

sents all the startling improvements and all the new features that have been developed through another flying decade. A newer ship—a faster ship—equipped with every new device that the engineering genius of a great industry has conceived.

And yet, she has this much in common with the old Spirit of St. Louis and with every other ship that ever took off on a successful transoceanic flight. She made it on B20P's!

On the long list of aircraft that have won B20P approval appear such well-known names as the Spirit of St. Louis, the Golden Age, the Atlantic, the Queen Mary, the Pan Am, the Market Clipper and planes of the coast air transport companies and of the United States Army and Navy. B20P Industries, Inc., 1000 First and One Avenue, Philadelphia, Pa.

AVIATION
August 1939
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SKF BALL AND
ROLLER
BEARINGS



FIVE MEN... A PLANE ... AND BREEZE SHIELDING

The greatest example of perfection in modern flight is the globe-circling feat of Howard Hughes and his four skilled technicians in their Wright Cyclone powered Lockheed 14.

Breeze was used on this flight more successfully than on any previous long distance flight. Constantly and unflinchingly Breeze Radio Shielding on both engine and plane were on the job—proof of the value of Breeze service to the industry.

Behind the glory and heroism of this great flight, lies a wealth of research, thought and tireless effort. Breeze is proud to have played a part in the preparations, thus contributing to the success of this epic adventure of five great men and their plane.

Breeze Products and their proven dependability are available to you.



BREEZE OF A S B
Radio Shielding Products, Accessories
Aircraft (and other) Bearings
Aircraft Engines and Motors
Aircraft Radio Equipment
Aircraft and other Bearings
Aircraft and other Bearings
Aircraft and other Bearings

B
STANDARD STEEL
DIVISION

Flangeless Bearings
and components of
bearing and other
steel products
and other products

A
REGULAR
CONTRACTORS

TO THE U. S. GOVERNMENT

AIRCRAFT PRODUCTS

Aircraft Bearings, Engines and Motors
Aircraft Engines and Motors
Aircraft Engines and Motors
Aircraft Engines and Motors
Aircraft Engines and Motors
Aircraft Engines and Motors

Radio Shielding Products, Accessories
Aircraft (and other) Bearings
Aircraft Engines and Motors
Aircraft Radio Equipment
Aircraft and other Bearings
Aircraft and other Bearings

BREEZE
CORPORATIONS, INC.
41 SOUTH SIXTH STREET • NEWARK, N. J.

ATTENTION
August 1939
16



PERFECT FLIGHTS DON'T JUST "HAPPEN"

★ Howard Hughes' epoch-making flight represents more than an outstanding achievement, it also represents an engineering achievement unsurpassed in aeronautical history.

Every material and part used in the plane was chosen with an uncompromising determination that it must be the finest available.

Under these conditions it is only natural that Mr. Hughes' Lockheed was equipped with Aerol Shock Absorbing Landing Gear Struts which are accepted by the industry as standard.

To support this selection engineers find an ample background of proven performance.

For over twelve years Aerol Struts have enjoyed a preferential position in the industry. They went with Byrd to the South Pole—with Ellsworth to the Antarctic—with Sir Hubert Wilkins in his several Polar flights. They flew with Dick Merrill in his two round trips across the Atlantic. They are on the big ships like the Douglas DC4, the Boeing XB15 and YB17, the latter the famous "Flying Fortress". Every day thousands of Army, Navy, Transport, and Training planes make better take-offs, safer and softer landings on Aerol Struts.

To any engineer not familiar with the exclusive air-and-oil principle of these struts we offer the services of our Technical Department.

THE CLEVELAND PNEUMATIC TOOL COMPANY

CLEVELAND, OHIO, U. S. A.

CABLE ADDRESS—"PNEUMATIC"

★ ★ ★

AEROL shock absorbing STRUT

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CONGRATULATIONS

TO HOWARD R. HUGHES • LT. THOMAS THURLOW • HARRY P. M. CONNOR

RICHARD STOODART • EDWARD LUND



On their record-breaking 91-hour flight around the world Howard Hughes and his companions used Goodyear Airplane Wheels and Hydraulic Brakes — standard landing gear on all Lockheed planes because long experience has proved its sturdy dependability. On stout Goodyear Wheels the heavily laden 12-ton ship roared down the runways into the air. Under the powerful, velvet-smooth, non-freezing action of Goodyear Hydraulic Disc Brakes it pulled up to safe, quick stops. Goodyear is proud of the part its equipment played in this great flight. Wouldn't it be a good idea to have this experience landing gear on your ship, too?

Goodyear airplanes of Lockheed Hydraulic Brakes used on American globe-gliding flight

On your new ship specify

GOODYEAR

AIRPLANE WHEELS AND BRAKES

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Our Compliments to
HOWARD HUGHES

LT. THOMAS L. THURLOW
HARRY P. M. CONNOR
RICHARD STODDART
EDWARD LUND—



—and to Wright and Lockheed and the other manufacturers whose products were used on this record-breaking flight around the world.



We are proud of the fact that Mr. Hughes flew with BG spark plugs and that they continue to prove their reliability under every flying condition. It is that reputation which has made these plugs

THE CHOICE OF THE AVIATION INDUSTRY

THE BG CORPORATION

Contractors to the United States Army and Navy and Aircraft Engine Builders
136 WEST 32nd STREET, NEW YORK . . . Cable Address: COLUMB, New York

★ ★ ★ ★ ★

3 DAYS-19 HOURS-17 MINUTES!



EAGERLY the world looked on as Howard Hughes, Lt. Thomas L. Thurlow of the United States Army Air Corps, Harry P. M. Connor, Richard Stoddart and Edward Lund completed their record-breaking flight around the world. Enthusiastically the world lauds their achievement!

SPERRY is particularly gratified that the speedy Lockheed "New York World's Fair 1939" carried a full complement of SPERRY instruments, including Directional Gyro, Gyro-Horizon, and Gyrocompass with remote control for the navigator—all of which performed perfectly during the entire flight.

SPERRY GYROSCOPE CO.

INCORPORATED

MANHATTAN BRIDGE PLAZA, BROOKLYN, N. Y.

★ ★ ★ ★ ★

AVIATION
August, 1931
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EXIDE RODE WITH HOWARD HUGHES AROUND THE WORLD



It took her just 31 1/2 months to fly around the world, proving that the mighty Exide's capabilities in road, ship and house use.

YOU planned it and you did it, Howard Hughes and your crew—well done! We are proud that Exide Batteries were part of your careful plans... Exide Aircraft-type batteries started Howard Hughes' ship, and furnished the current needed for landing lights, navigation lights, and instrument lights. These same dependable Exides supplied the major portion of the current required to send radio messages, and they stood by faithfully ready to furnish power when needed.

Exide World-Wide Service strikingly demonstrated by the flight... Duplicate Exide Batteries, fully charged, waited at the Paris, Moscow, and Fairbanks landing fields, in case Howard Hughes might need them.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturer of Storage Batteries for Every Purpose
Exide Division of Canada, Limited, Toronto

Exide
AIRCRAFT
BATTERIES

With Exide MPOR Separators
SAFETY—Non-U.S. Fuel Oil



AVIATION

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14,716 Miles, at 206.7 Miles per Hour!
FLYING ON



LOCKHEED-14, ALBERT HUGHES



The NORMA-HOFFMANN line of ball bearings sizes and new gear sizes affords PRECISION BEARINGS of unequaled reliability—for engines (including superchargers), engine accessories, control systems, instruments, radio equipment, compass, and landing field equipment. * * * Write for the Catalog. Let our engineers work with you.

Once again, by their performance in an epochal achievement, these NORMA-HOFFMANN PRECISION BEARINGS justified the confidence and approval of aviation experts. For such a supreme test as this, only bearings of proved dependability could be selected.

The Lockheed Plane (Lockheed Aircraft Corp., Burbank, Calif.) piloted by Howard Hughes in his record-breaking 'round-the-world flight, employed NORMA-HOFFMANN PRECISION BEARINGS in its control system, as well as in its Pioneer, Sperry and Kollsman instruments, and in the Fairchild radio compass Mark RC-6.

"Where the bearings must not fail—on land, at sea, or in the air—choose NORMA-HOFFMANN PRECISION BEARINGS!"

NORMA-HOFFMANN BEARINGS CORPN., STAMFORD, CONN. U.S.A.

AVIATION

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That's just one of the topics to be delivered anonymously by a masked speaker that will set every man thinking at the Annual Conference of National Industrial Advertisers Association in Cleveland, September 21-23. A second masked speaker will tell what he would do if he were a publication representative.

We're not going to tell you much here—just highlight the program enough to make your mouth water and your brain tingle.

T. M. Gardner, Chairman, Republic Steel Corporation, is scheduled for the opening address and when "T. M." talks he says something.

J. H. McGraw, Jr. will talk on "What I Would Do Now If I Were An Industrial Advertising Manager."

The new Publisher's Statement will receive full discussion.

Class sessions, as popular last year, will again cover a wide range of interesting subjects. Two half-day sessions instead of one.

A general conference session will cover such subjects as "Preparing the Plan," "How to Gather Useful Material," "Copy Technique," "How to Sell Management," "Coordinating

Sales and Advertising" and "How and Why to Use an Industrial Agency."

Another session will deal with "Problems of the Small Advertiser," "Production Problems," "Public Relations"—and there are many others.

If I were an Advertising Manager, I certainly would start now to make plans to attend the 19th N. I. A. A. Conference even if I had to hitch-hike to Cleveland. And I would send in my advance registration now to—Ed. Rossett, Bailey Meter Company, Lombard Road, Cleveland, Ohio.

IF I EMPLOYED AN ADVERTISING MANAGER

I would make certain that he attended this Conference, because changing times and markets demand a changed viewpoint—a new viewpoint that can be obtained only by hearing discussions by men whose experience is up-to-the-minute—right up to September 21st.



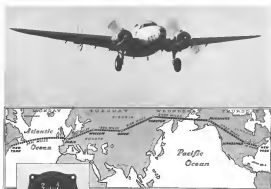
NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION

103 EAST OHIO STREET

CHICAGO, ILLINOIS

HOWARD HUGHES' SUCCESSFUL FLIGHT

... the result of careful planning



Mr. Hughes' "round the world" LOCKHEED, as well as other LOCKHEEDS of this type, is equipped with dependable electronic navigation instruments and other electrical instruments by WESTON.



WESTON salutes Howard Hughes, his flight associates, and the entire **LOCKHEED** organization on such skillful, sound planning.

Weston Electrical Instrument Corporation, 418 Folsom Street, Newark, N. J.

WESTON Instruments

Advertisers in business papers
enjoy widest consideration
when industry buys...

and widest
REPUTATION for
quality of **PRODUCT.**



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HUNDREDS OF TEST PILOTS WORK FOR EACH SPORTSMAN PILOT

* As a Sportsman pilot you don't have the means of thoroughly testing equipment before buying. But you needn't feel handicapped.

* Sport pilots are constantly being made by the millions, maintenance, Army and Navy, but their choice is your guide in buying.

* In that group, the long list of General tires works like the well oiled of American Aviation. So your recommendation that General will do a job on your plane.

GENERAL TIRE & RUBBER CO.
AKRON • OHIO



GENERAL *airplane tires*

KNOWN AROUND THE WORLD FOR SAFETY

B★A★30

B★A★30 airplane wing cloth is lighter, stronger and more closely woven than other airtail fabrics. Inquiries from dealers and manufacturers will receive prompt attention.

WELLINGTON SEARS COMPANY 25 HUNTER ST. NEW YORK CITY

Emblems—Service Pins—Watches
Trophies
Wristlets



JOHNSON
NATIONAL BUSINESS
CO., INC.
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N. Y. City
Est. 1884



PARTS • SUPPLIES • SERVICE
PACIFIC AIRMOTIVE CORP.
DESIGN AND TESTING, Los Angeles, California
SAN FRANCISCO OFFICE, 1000 Market Street, San Francisco, Cal.

AVIATION

AVIATION EQUIPMENT & EXPORT, INC.

23 BRAYED STREET, NEW YORK CITY, U. S. A.

CABLE ADDRESS: AVIEX-100



Alvin Karp, Harry Webb, Left, Remounting an over-hauled plane

"NICE WORK IF YOU CAN GET IT AND YOU CAN GET IT IF YOU TRY"

That quotation from one of today's popular songs hits the nail on the head. You can get work in the aviation industry, but to get it you've got to take a course of training and you've got to master it. After you've done that, you get your chance to enter aviation and your opportunity to advance as fast as you prove yourself capable and worthy. In this fast growing industry there are, literally, unlimited opportunities for success, the steps in which are: proper training; mastery of the course you take; determination, ability and character; the desire to continue to learn and the ambition to reach the top.

ROOSEVELT AVIATION SCHOOL

PROVIDES THE MOST IMPORTANT STEP—PROPER TRAINING

**FALL CLASSES START
SEPTEMBER 26**

SIGN AND MAIL COUPON TODAY

ROOSEVELT AVIATION SCHOOL—At Roosevelt Field, Mineola, Long Island, N. Y.
Without obligating me, send details of course checked:

- ☐ GOLD FLYER ☐ PRIVATE PILOT ☐ LIMITED COMMERCIAL PILOT ☐ COMMERCIAL PILOT ☐ AIRCRAFT BODY MECHANIC
☐ MASTER AIRPLANE MECHANIC ☐ MASTER AIRPLANE AND ENGINE MECHANIC ☐ AIRCRAFT DISMANTLER
☐ AIRCRAFT DESIGN AND CONSTRUCTION ☐ AIRCRAFT FLIGHT INSTRUCTOR

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City _____ State _____ Zip _____

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A. Jones, 1951



The great Douglas DC-4 (right) has been ground for the first time since by the new Curtiss-Wright Tech graduate pilot. Also Wright Tech graduate

MORE CURTISS-WRIGHT TECH GRADUATES WORKED ON THE DC-4
This time of any other school. Curtiss-Wright Tech doesn't guarantee positions for its graduates—no responsible school would—BUT



Mr. Donald Douglas
PRESIDENT OF THE DOUGLAS AIRCRAFT CO. SANTA MONICA, CALIFORNIA
Says in a letter to MAJOR C. C. ROBBY

"... During the past several years, we have employed a large number of your graduates and have found them to be outstanding workmen, efficient airplane men, and working with the men and problems connected with the Douglas Aircraft Company are the product of thorough training and are difficult to find. You are to be congratulated on the fine job your Institute is doing in training men such as..."

*No higher compliment can be paid Curtiss-Wright Tech and its graduates
—not is there any higher authority than Mr. Douglas.*

Curtiss-Wright Tech is APPROVED by the U. S. Government, ACCREDITED by the State Board of Education, ENDORSED by the Aircraft Industry and often specified training only in

AERONAUTICAL ENGINEERING OR MASTER MECHANICS

Partial listing for you mean in the heart of the Aircraft Industry. The only U.S. Government approved school of its kind in Los Angeles County. No flying school. Approved by the U.S. Department of Immigration for foreign students.

BE WISE—PROTECT YOUR FUTURE

Without obligation, check out the ratings and check out on the courses here checked:

MAJOR CAREER COURSES

☐ **MINISTERIAL ENGINEERING**—This is a new field of study, and is the only one of its kind in the world. It is a new field of study, and is the only one of its kind in the world. It is a new field of study, and is the only one of its kind in the world.

☐ **MASTER AIRPLANE MECHANIC**—This is a new field of study, and is the only one of its kind in the world. It is a new field of study, and is the only one of its kind in the world. It is a new field of study, and is the only one of its kind in the world.

SUPPLEMENTARY COURSES

☐ **PILOT TRAINING COURSE**—This is a new field of study, and is the only one of its kind in the world. It is a new field of study, and is the only one of its kind in the world. It is a new field of study, and is the only one of its kind in the world.

☐ **MASTERS ENGINEERING**—This is a new field of study, and is the only one of its kind in the world. It is a new field of study, and is the only one of its kind in the world. It is a new field of study, and is the only one of its kind in the world.

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CURTIS-WRIGHT TECHNICAL INSTITUTE
1000 CENTRAL AIR TERMINAL, GLENNDALE, CALIF. 91201

AVIATION
August, 1951
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1938

National
AIR RACES
Cleveland

Sept. 3. 4. 5

18TH ANNUAL
WORLD'S PREMIER
AIR CLASSIC

Traditional annual conferences of women – The most colorful of all spring gatherings – Concentrated into three days of greeting, competition – Swimming with flukes, speed and style – Partaking in the annual high speed land plane chase of the world, the 200 mile Thompson Trophy Race, the women meet spectacular transcontinental speedsters like Vincent Taurie Trophy Race – the don't miss intercollegiate 200 mile closed air tour of the Laguna W. Coast Trophy Race – All to participate Australia Aus. Pan-Am short flying and many amazing places of women

Small-scale commercial-scale fisheries without the better status of a licence

Reprinted by the National Research Council, American Medical Association, and the National Science Foundation

AMERICA'S GREATEST SPORTS EVENT



For the **UTMOST IN
PASSENGER COMFORT**

Equipped on millions of naturally resilient coiled hair springs, furnaces in the new Sealy Mattresses will guarantee the best word in business conduct.

Combines the unmatched versatility of varied hats with the many advantages of rubber. It is extremely light, porous, and non-melting—an ideal alternative to leather of every type. Wellbush is economical to the wear because the material is available in standard sheets and can be cut to shape. It is moulded from the most popular requirements. No tanning is required and the shape is maintained indefinitely. Wears away to scraps and moisture.

F. P. WOLL & COMPANY
FRANKFORD, PHILADELPHIA, PA.



RADIO BEACON RECEIVER

An ideal flight instrument for the private pilot. Well adapted to all small airplanes. Department of Commerce beacon signals 194 to 430 kilocycles. Very useful under Civil Air Regulations for cross-country flying. Weight is less than ten pounds.

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Motion of Aircraft India for the Best Tax Treaty

RADIO FREQUENCY LABORATORIES, INC.
ROCKTON, N. J.

TODAY it's Wings over the **Esso** Mark



This new sign at leading airports identifies new products of new high quality backed by the oil industry's leader

This is the latest step in a story that dates back to Kitty Hawk, when we supplied the fuel for the Wright Brothers. From that day to this, we have been a vital part of aviation development. Through the years, aviators have relied on our products for historic flights and for the heavy grind of every-day service.

Now, these products are known under the brand name ESSO because in test and in use they have proved themselves clearly superior and worthy of the Esso mark.

Distributed at airports supplied by the following major oil companies: Standard Oil Company of New Jersey, National Business Oil Company, Inc., Standard Oil Company of Pennsylvania, Standard Oil Company of Louisiana, Standard Oil Company (Ohio), Standard Oil Company (Ind.) in Kentucky.



HIGHER VISCOSITY INDEX
insures lubrication of all engine parts operating at extremes of temperature. Greater film strength increases cylinder and piston life. Approved by all leading engine builders.



通學主觀評定分數

ECLIPSE-EQUIPPED



THE INTERNATIONALLY-ACCEPTED STEARMAN

is chosen each year, by more and more governments as their official military training planes. These sturdy aircraft are ruggedly built—and readily adaptable to the many rigorous requirements of military aviation. Significantly, Stearmans feature Eclipse equipment as standard. Starters, generators, dynamotors, vacuum instrument pumps, are all of Eclipse manufacture. This acceptance is proof again of the high regard in which the aviation industry holds Eclipse Products.

ECLIPSE AVIATION DIVISION
OF BENDIX AVIATION CORPORATION
EAST ORANGE, N. J.